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MacBook Pro (13-inch, 2020, Two Thunderbolt 3 Ports) Overview

MacBook Pro (13-inch, 2020, Two Thunderbolt 3 Ports) Overview



Features

- **Processor:** 1.4GHz quad-core 8th-generation Intel Core i5, configurable to 1.7GHz quad-core 8th-generation Intel Core i7
- **Storage:** 256GB, configurable to 2TB
- **Memory:** 8GB of 2133MHz LPDDR3 onboard, configurable to 16GB



Important Service Considerations

- **Important:** Only [Apple-certified technicians](#) should repair this computer.
 - **Battery Safety:** Before beginning any repair procedure, install the battery cover, disconnect the Battery Management Unit (BMU) flex cable and remove the BMU screw.
 - **Battery Service:** The battery is not a replaceable part. Never remove the battery from the top case. To replace a battery, you must replace the top case.
 - **Diagnostics:**
-
- **System Configuration:** [System Configuration](#) must be performed after a **display, logic board, Touch ID board, and top case** repair.
 - **Logic Board and Touch ID Board:** If you replace the logic board, you must also replace the Touch ID board. However, you don't need to replace the logic board if only the Touch ID board is replaced.
 - **Audio Board Flex Assembly:** The audio board flex assembly has a Hall effect sensor flex cable attached to it. The whole assembly must be replaced anytime it is removed from the top case to ensure the functionality of the Hall effect sensor is not compromised.
 - **Bottom Case:** The bottom case must be serviced with the bottom case removal/install fixture kit (076-00290).
 - **Right and Left Speakers:** The right and left speakers are paired and only offered as a kit. If you need to replace one speaker, you must replace both. Don't save a used, good speaker for another repair. The speakers are calibrated as a pair by the manufacturer and will not operate properly if mismatched.

Use Software Update

MacBook Pro (13-inch, 2020, Two Thunderbolt 3 Ports) ships with a model-specific version of macOS. [Use the Mac operating system that came with your Mac, or a compatible newer version](#) to make sure the system build is correct for this computer model. Use Software Update to check for and apply the latest software and firmware updates.

MacBook Pro (2016-2020) Serial Number Locations

The system serial number and model number are located on the bottom case. Turn over the computer to view the numbers etched on the bottom case near the hinge.

Note: Bar code readers can be used to read serial numbers inside the computer.

Model and EMC Numbers

Models	Model Number	EMC Number
2016		
MacBook Pro (13-inch, 2016, Two Thunderbolt 3 Ports)	A1708	2978
MacBook Pro (13-inch, 2016, Four Thunderbolt 3 Ports)	A1706	307
MacBook Pro (15-inch, 2016)	A1707	3072
2017		
MacBook Pro (13-inch, 2017, Two Thunderbolt 3 Ports)	A1708	3164
MacBook Pro (13-inch, 2017, Four Thunderbolt 3 Ports)	A1706	3163
MacBook Pro (15-inch, 2017)	A1707	3162
2018		
MacBook Pro (13-inch, 2018, Four Thunderbolt 3 Ports)	A1989	3214
MacBook Pro (15-inch, 2018)	A1990	3215
2019		
MacBook Pro (13-inch, 2019, Two Thunderbolt 3 Ports)	A2159	3301
MacBook Pro (13-inch, 2019, Four Thunderbolt 3 Ports)	A1989	3358
MacBook Pro (15-inch, 2019)	A1990	3359
MacBook Pro (16-inch, 2019)	A2141	3347
2020		
MacBook Pro (13-inch, 2020, Two Thunderbolt 3 ports)	A2159	3301
MacBook Pro (13-inch, 2020, Four Thunderbolt 3 ports)	A1989	3358



Transferring the System Serial Number

When replacing a bottom case, retain the user's original bottom case until the repair is complete. Before installing a replacement bottom case, use a fine-tip permanent marker to write the original system serial number inside the bottom case.



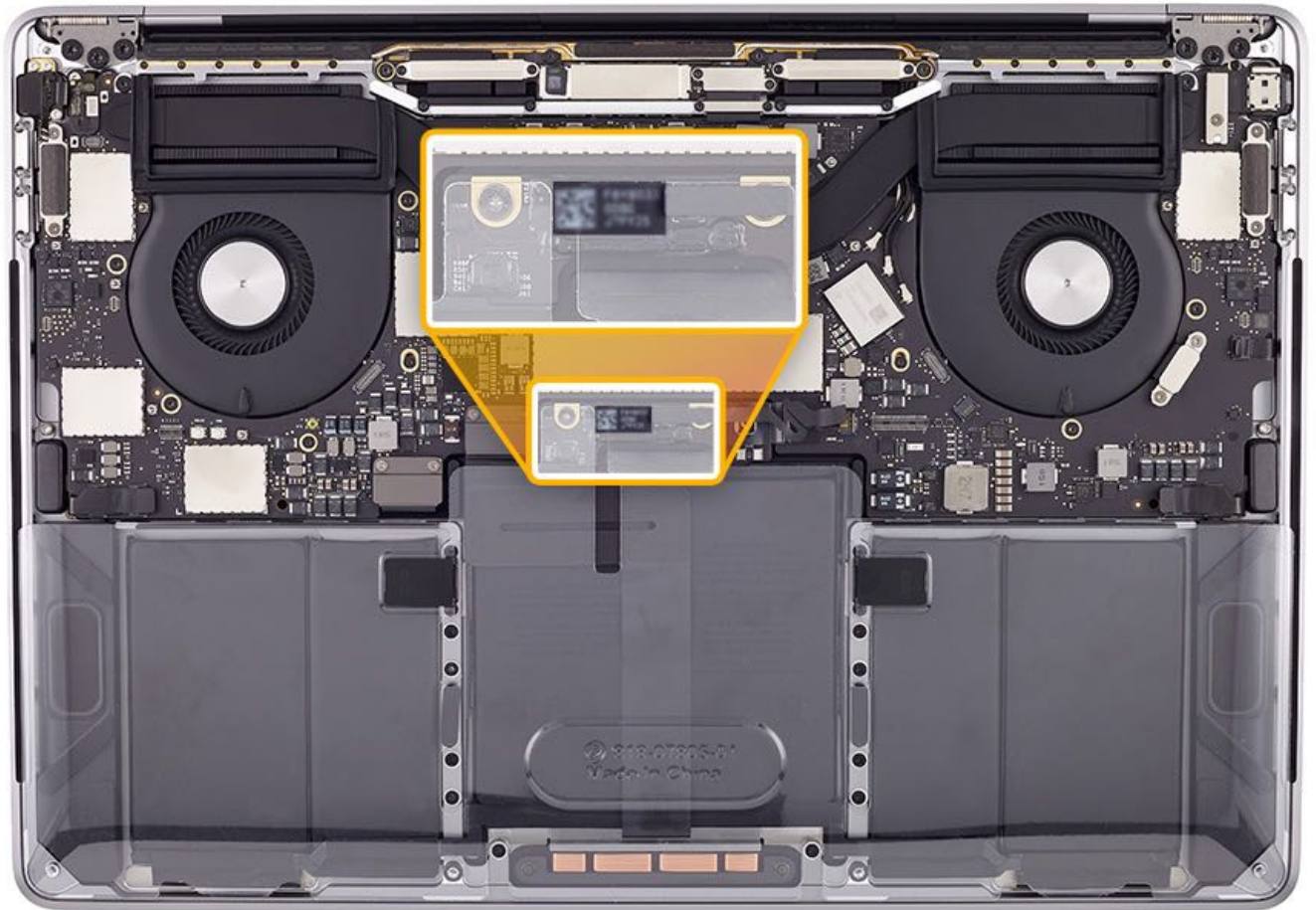
Battery Serial Number

Copy the original battery serial number when reporting a top case return to Apple. Do not copy the replacement serial number.

An example of a MacBook Pro (13-inch, 2016 and 2017) and MacBook Pro (13-inch, 2019 and 2020, Two Thunderbolt 3 Ports) battery serial number, located underneath the trackpad flex cable, is shown below. Carefully peel back the trackpad flex cable to view the battery serial number.



An example of a MacBook Pro (13-inch, 2018, 2019, and 2020, Four Thunderbolt 3 Ports) battery serial number, located on the BMU board, is shown below.



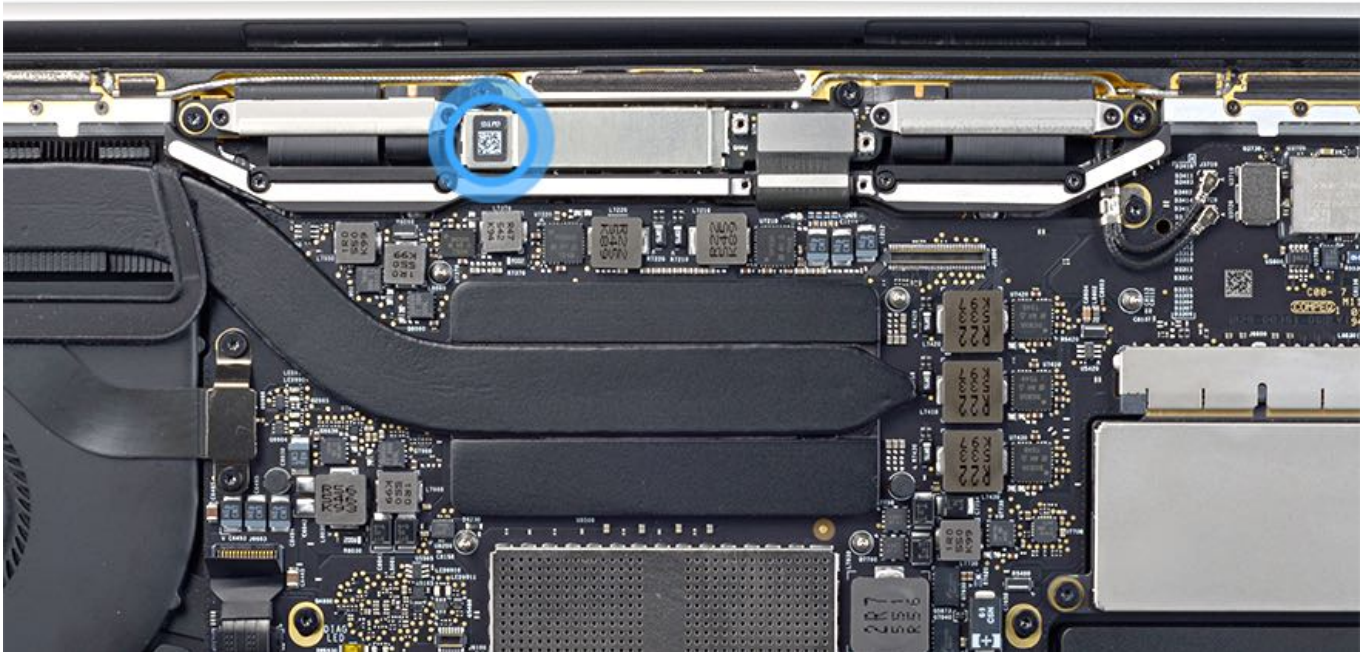
An example of a MacBook Pro (15-inch, 2016 - 2019) and MacBook Pro (16-inch, 2019) battery serial number, located on the BMU board, is shown below.



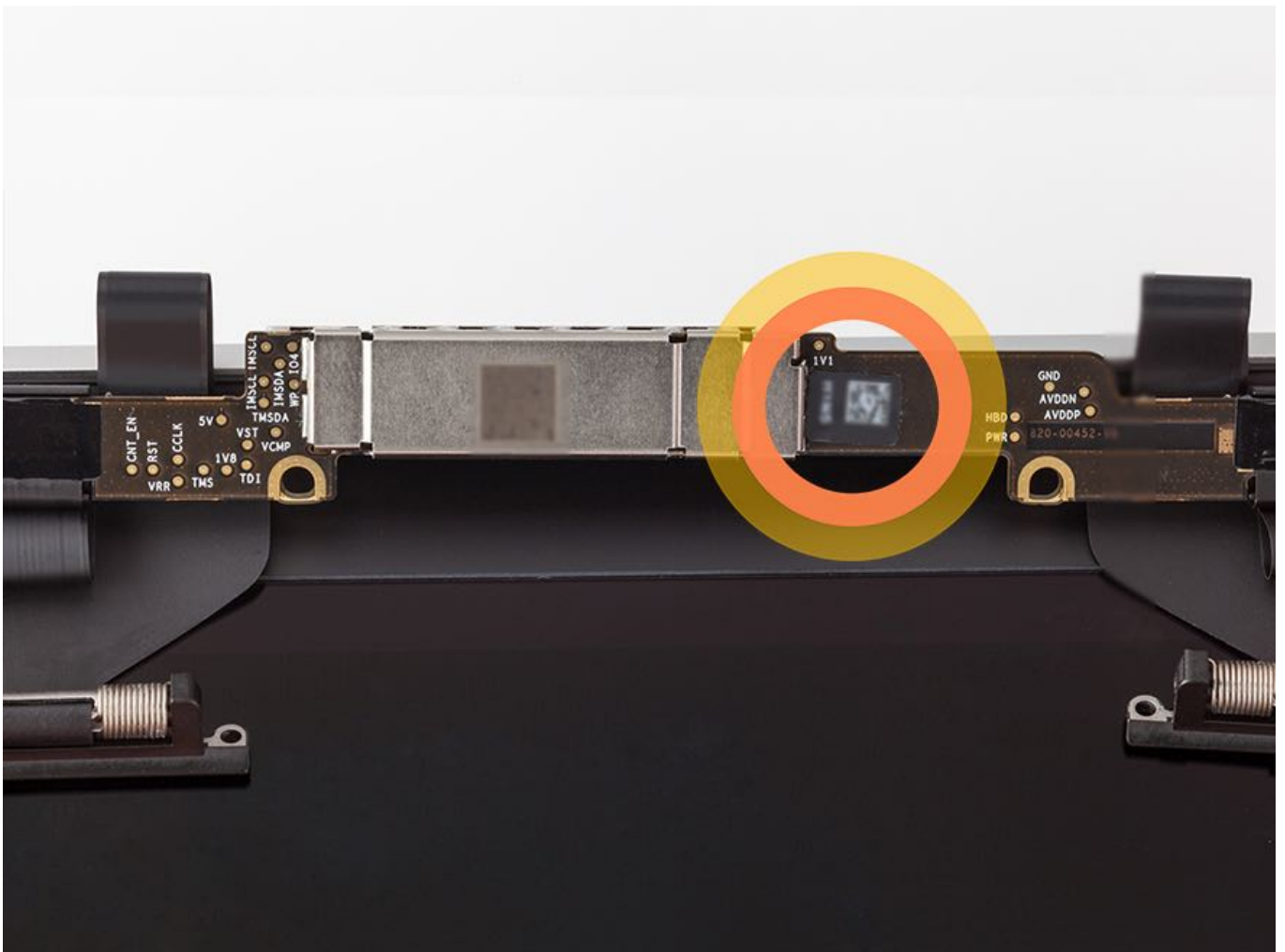
Display Assembly Serial Number

The display assembly serial number is located on the TCON board.

An example of a MacBook Pro (13-inch, 2016 - 2020) and MacBook Pro (16-inch, 2019) display assembly serial number is shown below.



An example of a MacBook Pro (15-inch, 2016 - 2019) display assembly serial number is shown below.



Portables (Mid 2012 and later) Battery Safety Setup

Battery Safety Setup for MacBook, MacBook Air, and MacBook Pro (Mid 2012 and later)



Warning: Before servicing a portable computer, read and understand [Safely handling lithium batteries and lithium battery-powered devices](#).

For information on how to set up your workstation, refer to [Embedded battery workstation setup for Apple notebook computers and iPhone](#).

Data Transfer for Mac Computers with the Apple T2 Security Chip

Mac computers with the Apple T2 Security Chip have security features that require a specific [data transfer process](#) . You may be able to transfer data from a damaged logic board before you service it.

Important:

- This data transfer procedure is only for transferring data from a Mac computer with an Apple T2 Security Chip to an external hard drive.
- If the logic board or flash storage on the user's computer isn't damaged, you can [move content directly from the user's computer to another Mac computer with an Apple T2 Security Chip](#) .
- If you replaced the logic board or flash storage on the user's computer, ensure the data is backed up. You can't recover data after running System Configuration.
- The user's computer is unresponsive during the data transfer.

Note: After you complete a logic board or flash storage repair and run System Configuration, the user's computer is responsive. If you have not done a repair, [restore firmware in Apple Configurator 2](#).

- You can't modify files and folders from the volumes on the user's computer. Volumes on the user's computer are read only.

Caution: After the transfer process, some files such as .bin, .etc, .tmp, and .usr may be visible on the external hard drive. This is normal. Don't delete or modify these files or folders or you may cause issues for the customer when they migrate information from the external hard drive back to the user's computer.

- The external hard drive takes 10–20 minutes to be partitioned.
- Data is transferred at USB 2.0 speed. The time it takes to complete the data transfer depends on how much data is on the user's computer, and could take up to four days.
- When the data transfer is complete, return the external hard drive with the user's data to the user. If the data successfully transferred, tell the user how to [use migration assistant to migrate their data back to their computer](#)

Tools:

- Power cord
- USB-C Charge Cable (661-06670) or USB-C to USB-A Cable (923-00504)



- A host computer with:
 - macOS Catalina 10.15 or later
 - Mac Configuration Utility (MCU).
 - An internet connection
 - An external hard drive of equal or greater storage capacity than the storage capacity of the user's computer
- Note:** The external hard drive will be configured and password protected with the user's computer serial number during the data transfer.

Steps:

1. Add Retail Data Transfer Setup (076-00399) or ASP Transaction Only Data Transfer Setup - Transaction Only (076-00410) to the repair and save the repair.
2. Open the AST 2 [Diagnostic Console](#) and enter the user computer's serial number to start a diagnostic session.
3. Connect the user's computer to the host computer. If the host computer doesn't have a USB-C port, use a USB-C to USB-

A cable.

Important: You must connect the USB-C cable to the correct port on the user's computer.

Notebooks: Use the USB-C port closest to the Caps Lock key.



iMac Pro: Use the USB-C port closest to the Ethernet port.



Mac mini (2018): Use the USB-C port closest to the HDMI port.



Mac Pro (2019): Use the USB-C port closest to the edge.



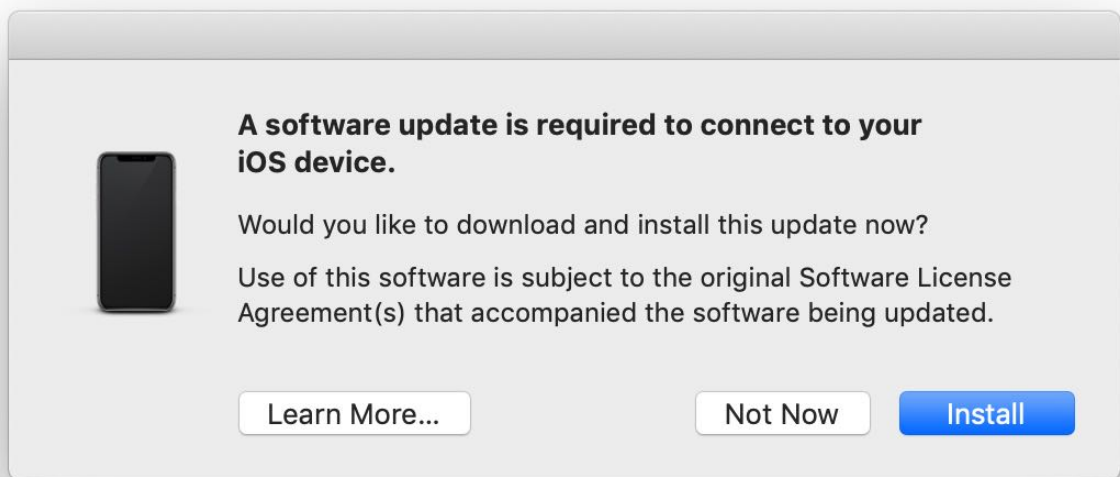
Mac Pro (Rack, 2019): Use the USB-C port closest to the power button.



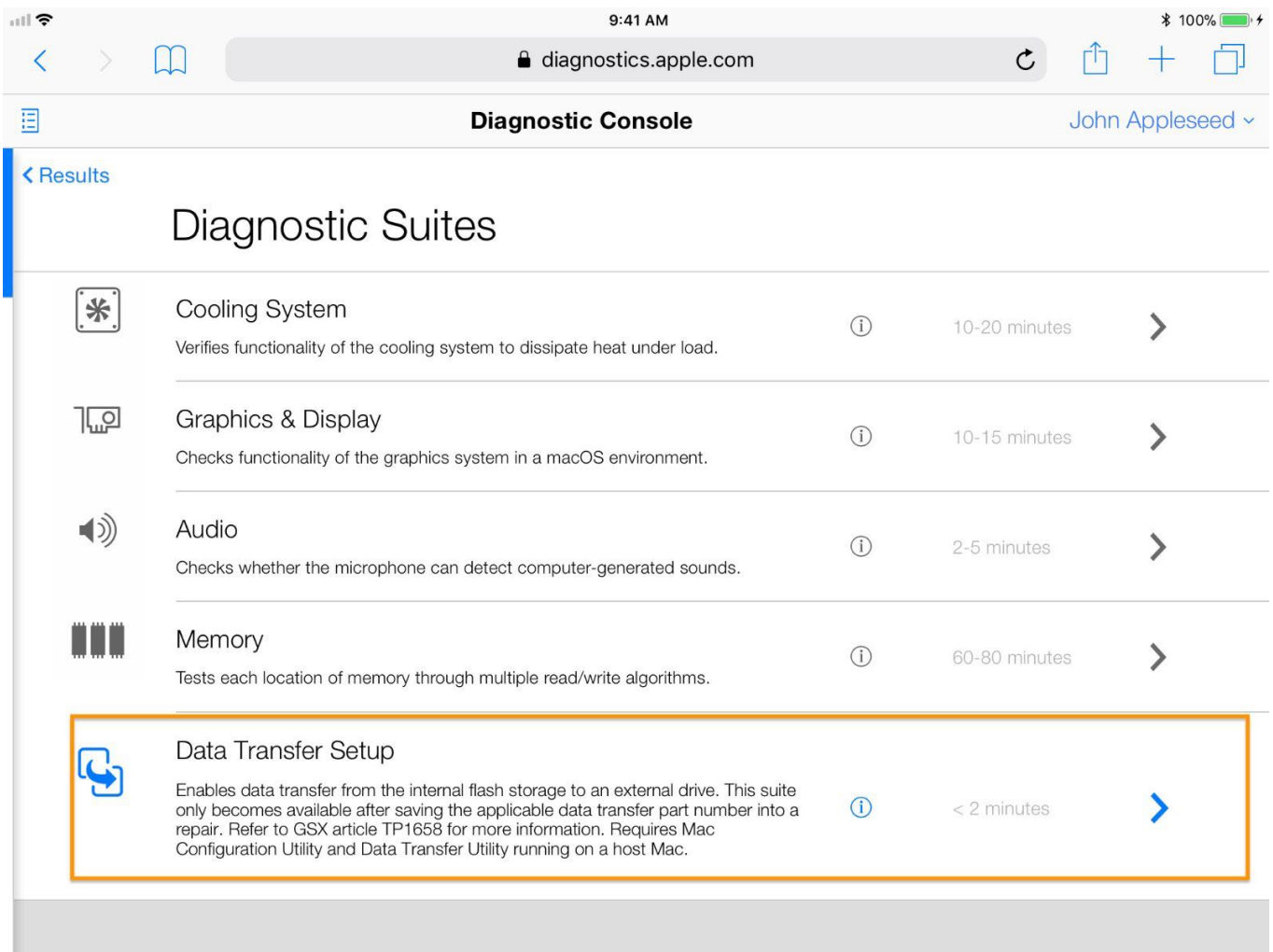
4. Turn on the host computer, connected it to power, and connected it to the internet.
5. Start up the user's computer in [DFU mode](#) .
 - [For desktop computers](#) , press and hold the power button while connecting the power cord until the prompt appears in Mac Configuration Utility, which may take up to 10 seconds.
 - [For notebooks](#) , press and hold the power button, then press and hold Left Control-Left Option-Right Shift until the prompt appears in Mac Configuration Utility, which may take up to 10 seconds.



Note: If an alert message appears prompting a software update, choose "Install." After the installation is complete, continue to the next step in the System Configuration process. MCU will automatically launch and a dialog box will appear on the host computer screen.



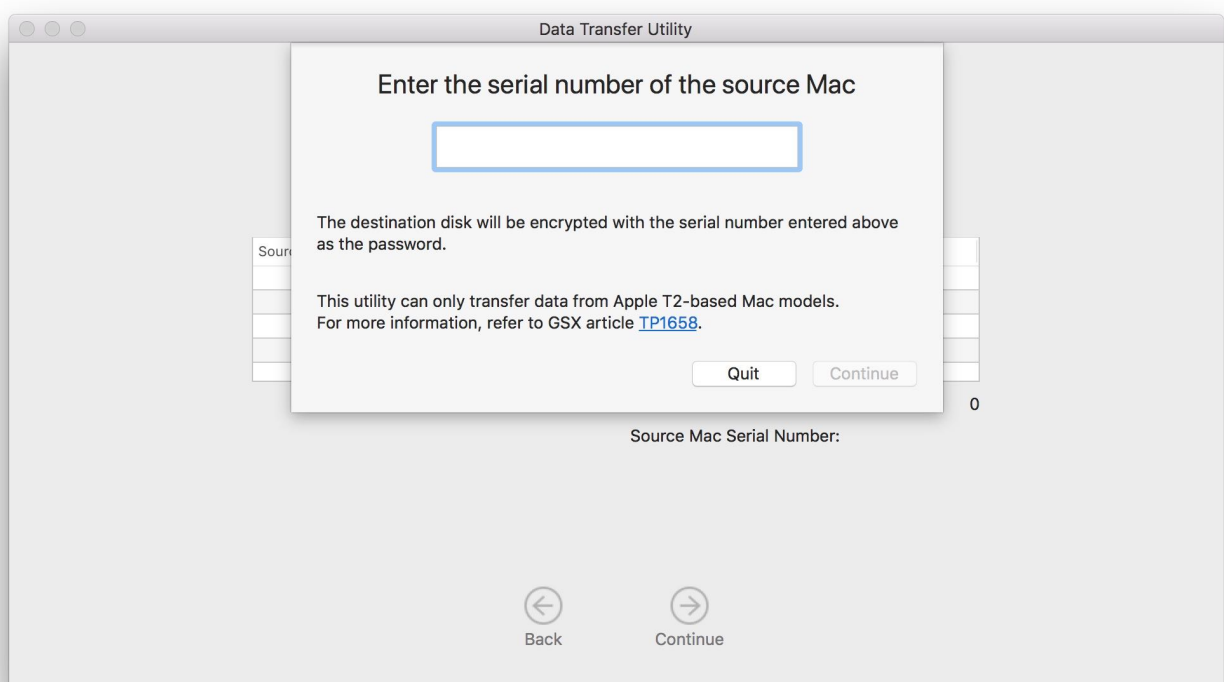
6. Select Data Transfer Setup from the list of diagnostic suites in the Diagnostic Console.



Note:

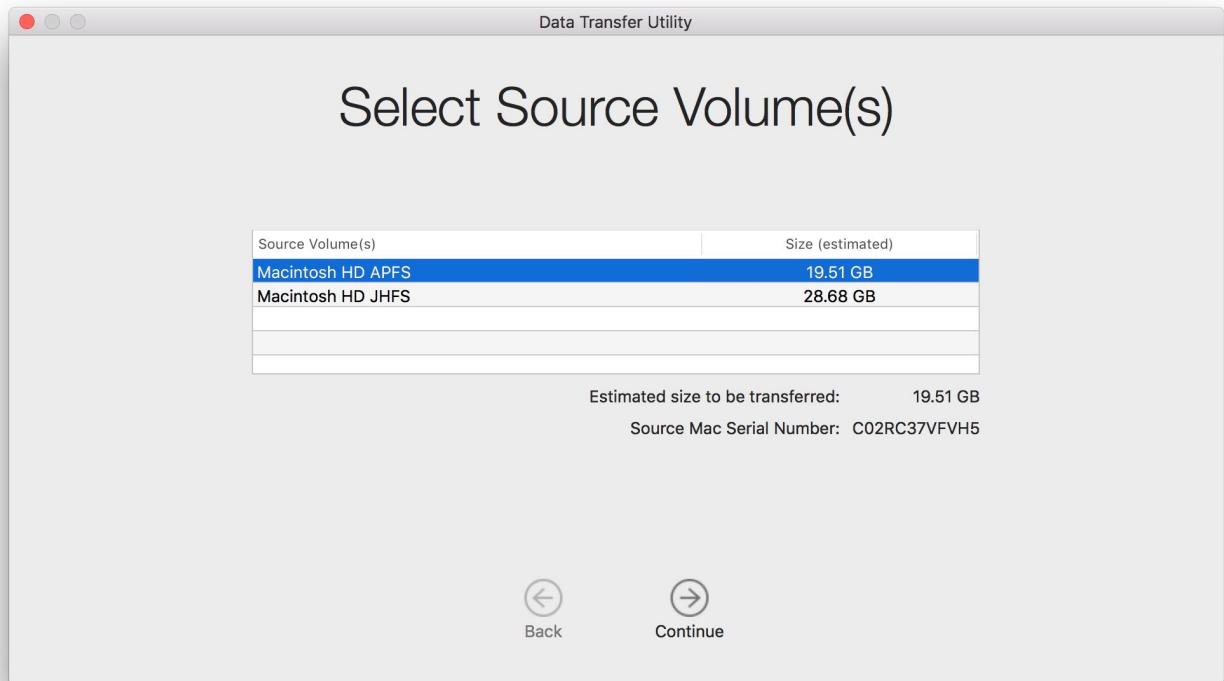
- If the user's computer has FileVault enabled, you will be prompted to enter the password.
- Nothing will appear on the user's computer screen to indicate status. The only status indication will be when the drive mounts as an external volume on the host computer running MCU.

7. Open the Data Transfer Utility app on the host computer and enter the serial number of the user's computer.

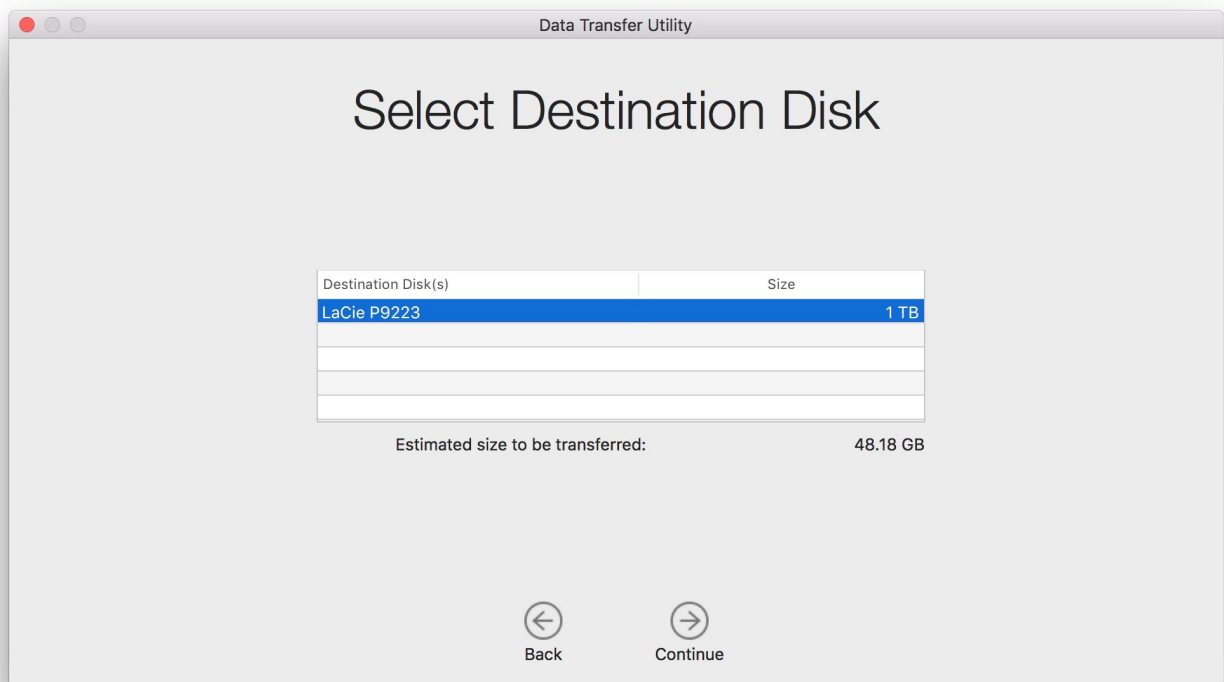


8. Select the source volume and click Continue.

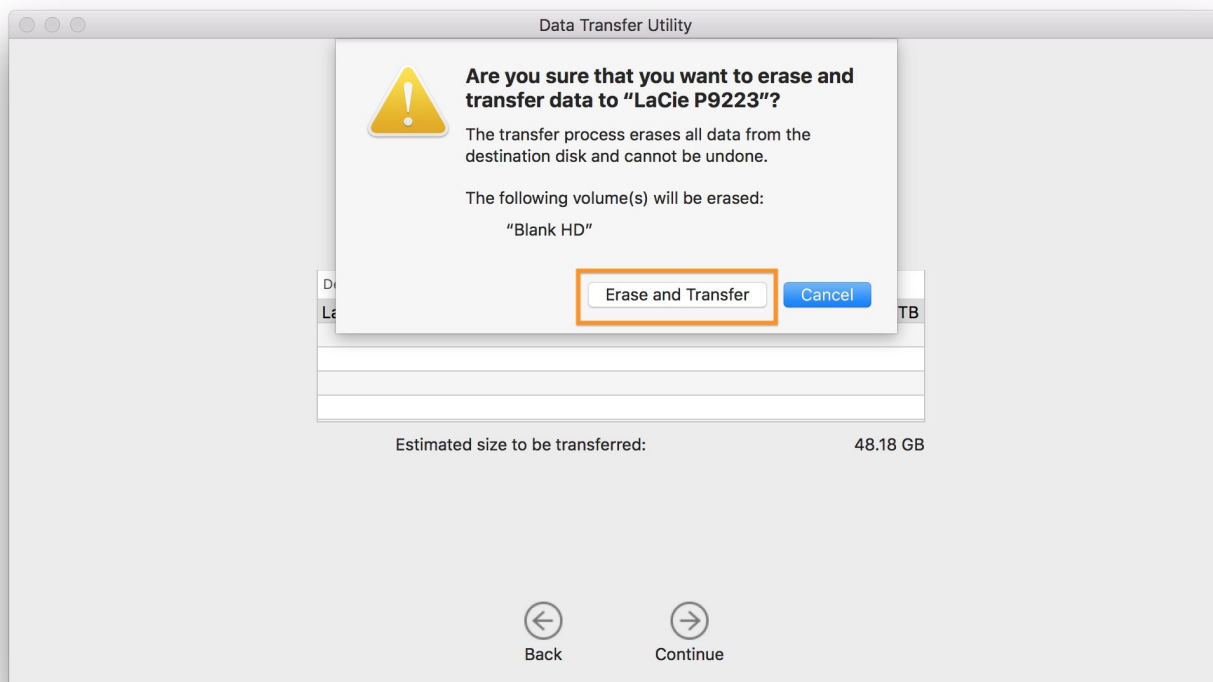
Note: If more than one source volume is available, you can select multiple volumes to transfer.



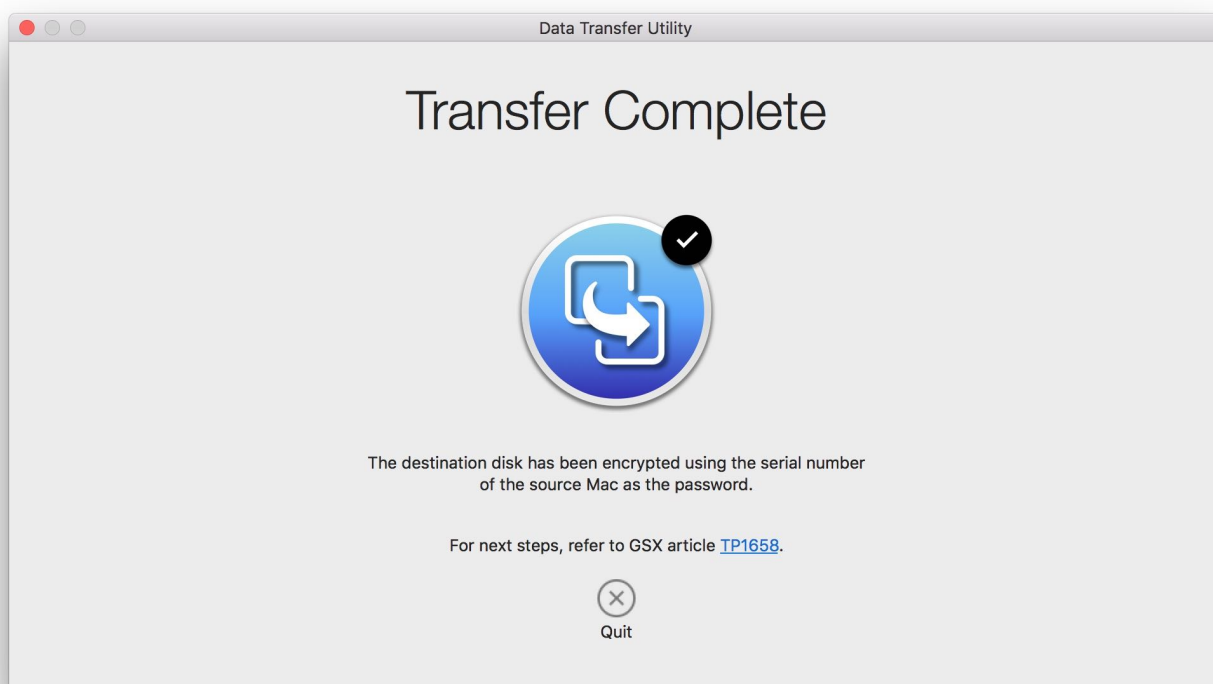
9. Connect an external hard drive to the host computer. Select the destination, and click Continue.



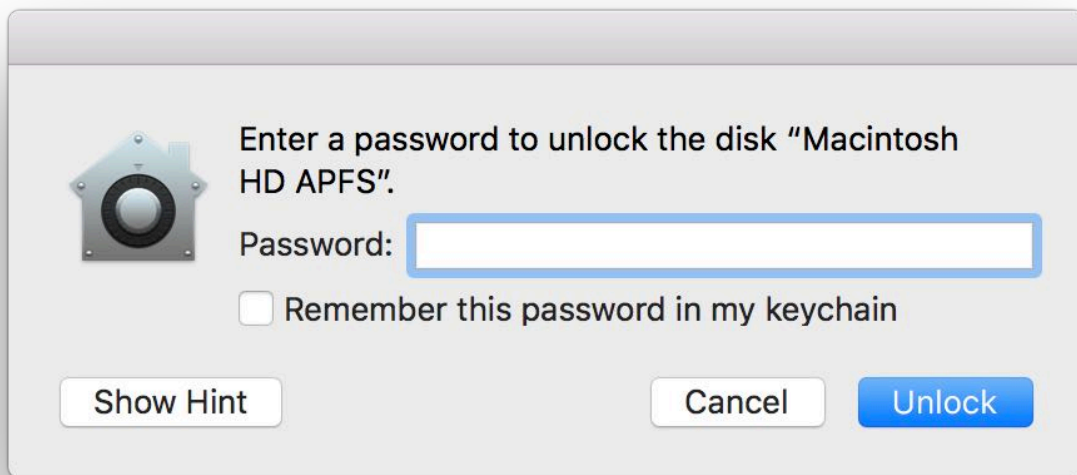
10. Click Erase and Transfer.



11. Confirm that the transfer is successful before closing the repair. Once you close the repair, you can't transfer data again from the known bad (KBB) logic board.



12. Ensure that the password works and the external hard drive is encrypted by disconnecting it and reconnecting it to the host computer.



Troubleshooting Tips:

If the Data Transfer Setup suite is unavailable, verify the following information:

1. You added the correct data transfer part number and saved—but didn't close—the repair.
2. You entered the correct serial number of the user's computer into the Diagnostic Console.
3. You used the serial number of the user's computer to create the repair.
4. You correctly connected the user's computer to the host computer, and Mac Configuration Utility is running. A correctly connected device will show as "Apple Mobile Device (DFU Mode)" in System Information > USB.
5. You didn't use a USB-C to USB-A cable with USB-C to USB Adapter.

If the user's computer doesn't complete the Data Transfer Setup suite, perform the following steps:

1. Archive and restart the diagnostic session. Re-run the Data Transfer Setup suite.
2. Restart the host computer.

If the Data Transfer Utility app doesn't show any volumes under Select Source Volume(s), verify the following information:

1. Volume(s) appear in Finder or Disk Utility.
2. You entered the correct serial number of the user's computer into the Data Transfer Utility app.

If the Data Transfer Utility app doesn't recognize the external hard drive, use Disk Utility to initialize the external hard drive.

Keycap Replacement

Keycap Replacement for the following models that use the scissor mechanism for the keycaps:

- MacBook Pro (16-inch, 2019)
- MacBook Air (Retina, 13-inch, 2020)
- MacBook Pro (13-inch, 2020, Two Thunderbolt 3 Ports)
- MacBook Pro (13-inch, 2020, Four Thunderbolt 3 Ports)



This is the quickest and most cost-effective procedure for fixing the following symptoms:

- Key stuck in up or down position
- Key press feels uneven or stiff
- Keycap not responding

The procedure involves three basic steps:

Note: This procedure may seem familiar, however there are some important differences. Always be sure that the lever tool is pointing in the proper direction. For direction, see the map below.

1. Applying the adhesive to the keycap lever tool.
2. Pressing and holding the keycap lever tool on the keycap for 10 seconds.
3. Pulling the keycap in the correct direction to release snaps.



Note: If a keycap replacement does not resolve the issue, you must replace the entire top case. To confirm the correct keyboard country code and part number, refer to [How to identify keyboard localizations](#). Use the exploded view in the service guide to confirm the correct top case part number before ordering a service part.

First Steps

- Before replacing the keycap on an unresponsive keyboard, be sure to clean the keyboard thoroughly with compressed air. Then remove the keycap, spray the well with compressed air, and check for liquid damage.
- Always install a new keycap. Do not attempt to reinstall the keycap that was removed.

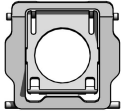
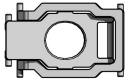
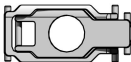
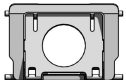
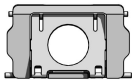
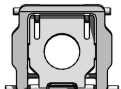
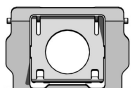
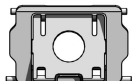
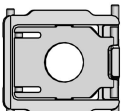
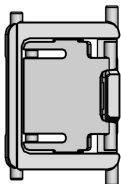
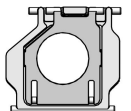
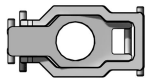
1. Keycap Kit Part Numbers

Important: Keycap kits vary by computer color and keyboard language.

Part Number	Label Number	Language
923-03854	605-06246	US English (ANSI)
923-03855	605-06247	ANSI Common Keys
CH923-03854	CH605-06246	Chinese (ANSI)
KH923-03854	KH605-06246	Korean (ANSI)
B923-03854	B605-06246	British English (ISO)
ZM923-03854	ZM605-06246	ISO Superkit
ZM923-03855	ZM605-06247	ISO Common Keys
J923-03854	J605-06246	Japanese (JIS)
J923-03855	J605-06247	JIS Common Keys
AB923-03854	AB605-06246	Arabic (ISO)
FE923-03855	FE605-06247	Far East Common Keys
923-03429	605-00253	MacBook Air Function Row

2. Scissor Map

There are 11 different scissor types in the scissor kit (923-03863). The MacBook Air (Retina, 13-inch, 2020) has an additional function row scissor that ships with the function row keycaps (923-03429). Use the maps below to see which scissor to use if it is necessary to replace a scissor. A scissor only needs to be replaced if it is broken.

Symbol	Scissor
A1	
B1	
C1	
D1	
E1	
F1	
G1	
H1	
I1	
J1	
K1	
L1 MacBook Air (Retina, 13-inch, 2020) only	

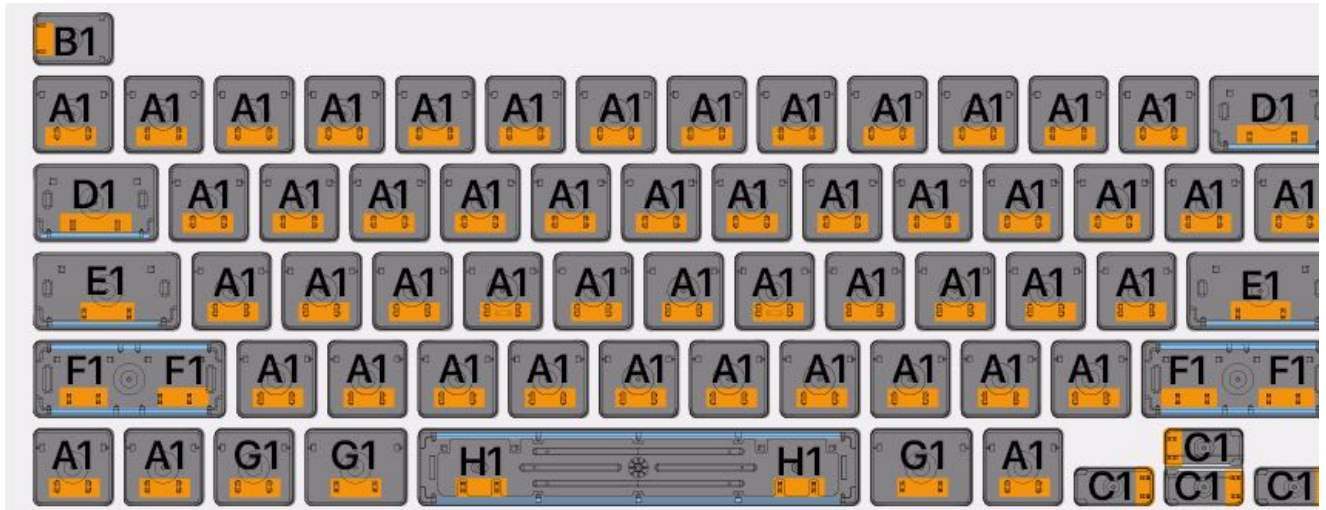
The symbols on the map below correspond to the symbol on the scissor bag. Orange indicates where the snaps

are located and the blue indicates link bars.

Note: MacBook Air (Retina, 13-inch, 2020) keyboard has an additional row of keys.



ANSI



ISO



JIS



3. Procedure for Removing and Replacing Keycaps

Caution:

- Shut down the computer before replacing a keycap.
- Press the keycap lever very gently on the keycap when initializing the VHB adhesive strip. The top case should not bend when pressing the keycap lever onto the keycap.
- Only the keycaps and scissors are replaceable. A damaged dome or metal hooks requires a top case replacement.
- Check the rubber dome and raised metal areas inside the keycap well.
 - When the rubber dome is pressed and released, it should spring back upright. If the rubber dome is off center or damaged, replace the top case.
 - If the metal hook that holds the slider bar of the scissor mechanism is bent, try to bend it back to a uniform 90-degree angle. If it is bent or broken beyond repair, replace the top case.
 - If the two metal ears are bent, use needlenose pliers to straighten them. If either or both ears are broken beyond repair, replace the top case.

Tools:

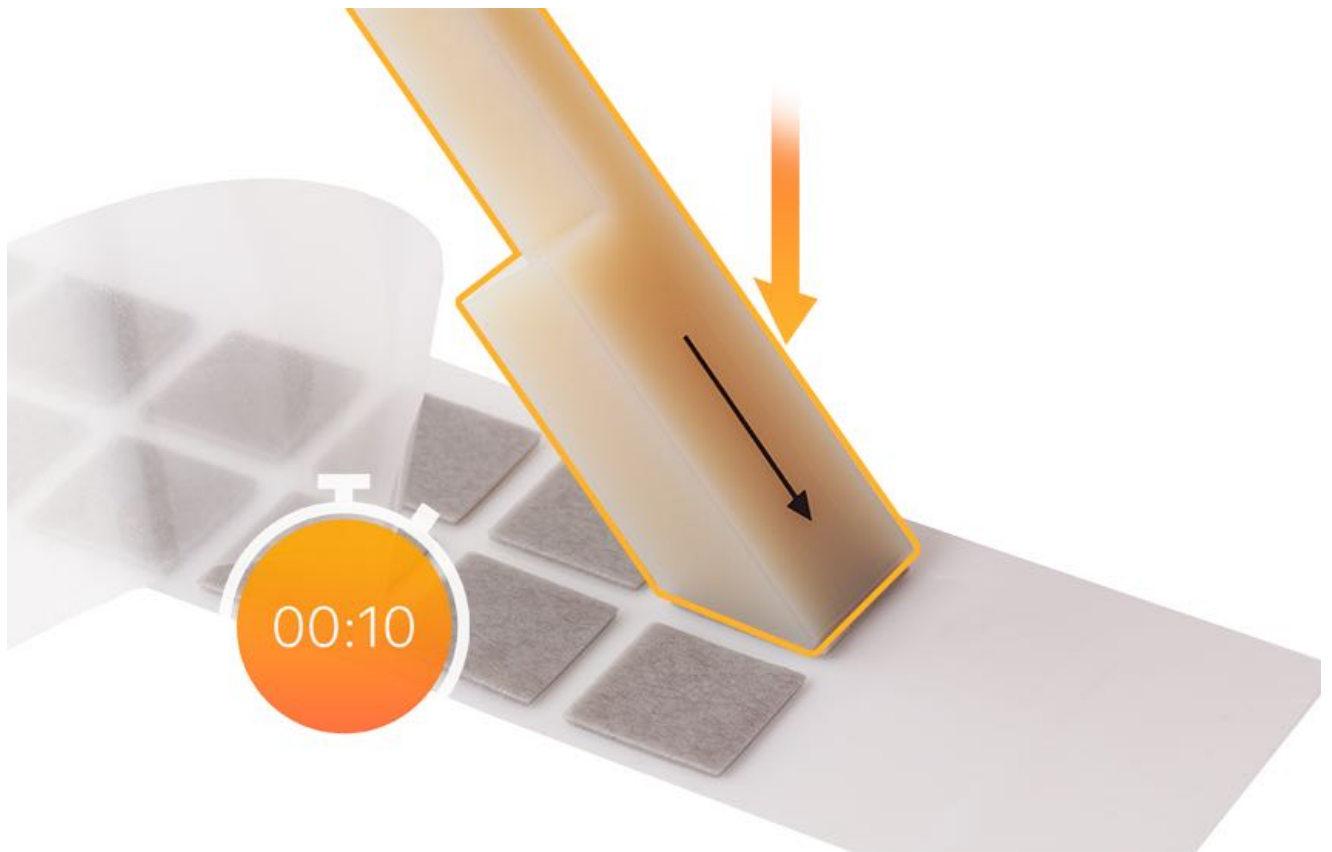
- Compressed air
- Precut VHB Strips (923-01801, 1x1; 923-01800, 1x.5)
- Keycap Lever (923-01803) **Note:** This tool is double sided. The smaller side is used for the arrow keys and Escape key.
- Keycap Lever Kit (076-00457) includes: Keycap lever and precut VHB strips
- Black stick
- ESD-safe tweezers

Follow these steps to remove and replace a keycap.

Each type of key on the keyboard requires a specific procedure.

A. Removing and Replacing 1x1 keys**Removal**

1. Peel back the frosted liner from one side of the precut VHB strip. Press the large end of the keycap lever onto the 1x1 adhesive and hold for 10 seconds.



2. Lift the keycap lever, with the adhesive attached, from the clear liner.

3. Lightly press the keycap lever with the adhesive side down onto the key. **Important:** The arrow on the lever must always point to the hinged side of the keycap (toward the display) so the lever is always tilting away from the snaps and toward the hinge. Refer to the Scissor Map above for the location of the snaps. **Note:** The Caps Lock key on the JIS keyboard is different. Be sure to refer to the map.

4. Hold for 10 seconds to activate the adhesive.

Note: The adhesive is very strong. If the keycap lever is accidentally placed onto the wrong keycap, continue with the removal process and replace with a new keycap.



5. Lift the lever tool in the direction of the arrow until you hear the snaps release. Then lift the keycap off of the keyboard.

Caution: Be sure not to tilt the keycap more than 20-degrees. Doing so could cause the the scissor mechanism to become damaged.



6. Once the keycap has been removed, use a black stick to carefully and gently lift the scissor up and down to

check that it moves easily and lies flat when released. For easier inspection, turn on the keyboard backlight to illuminate the scissor.



7. Use compressed air to clean the keycap well. **Note:** If compressed air does not dislodge visible debris, use a black stick to gently dislodge the debris.

8. Remove the keycap and the adhesive from the keycap lever and discard both. **Note:** The adhesive is one-time use only and must be replaced for every keycap removal.

Reassembly

Important: Always replace the removed keycap with a new one. Do not reuse keycaps.

1. Insert the hinged side of the keycap into the well at a 15-degree angle and gently push to engage the hinges.



2. Gently push down on the top of the keycap to engage the snaps.



3. Tap the key repeatedly to verify that it springs back each time. Compare the response of the new keycap with the response of the keycaps around it.

4. If the keycap does not appear to be correctly installed, start again at removal step one with a new keycap.

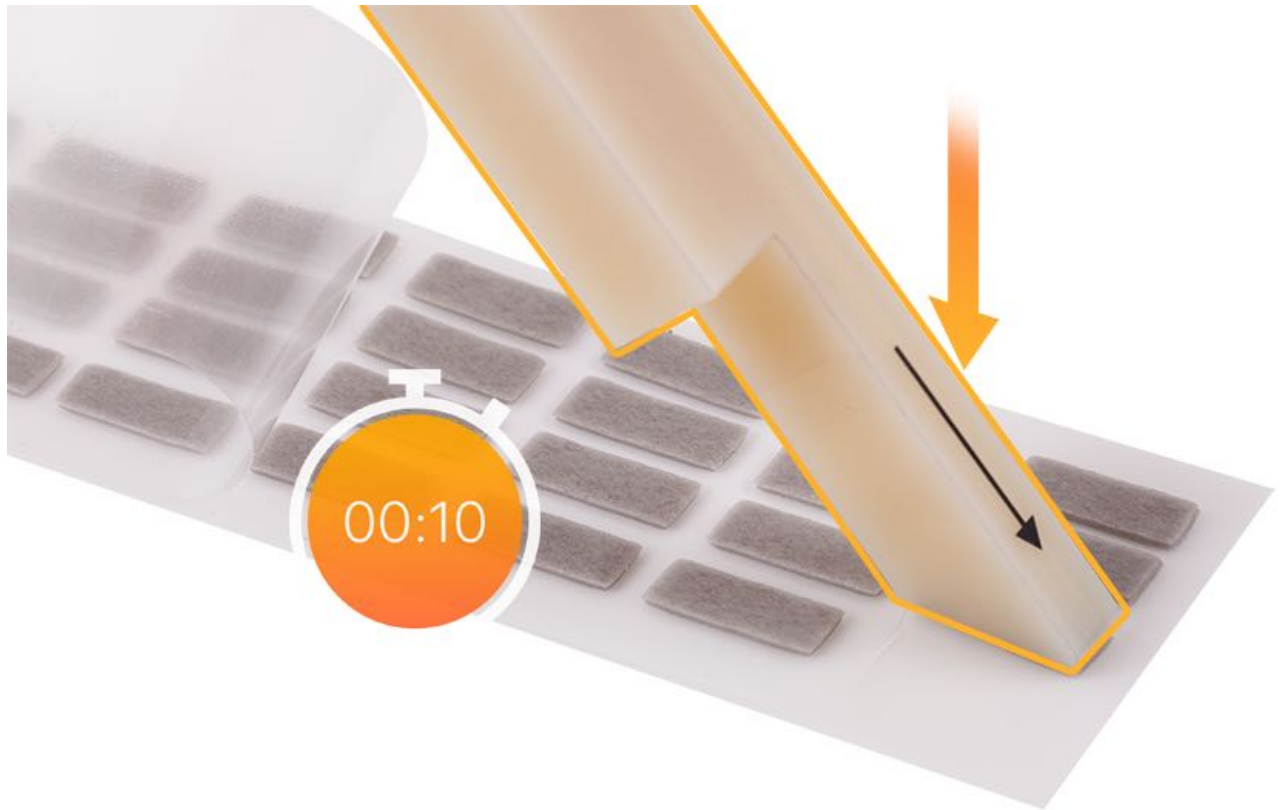
B. Removing and Replacing Arrow Keys and the Escape Key

Important:

- For the bottom row arrow keys, the hinges are on the left, so the arrow on the lever tool points toward the left.
- For the up arrow key and the escape key the hinges are on the right, so the lever tool arrow points toward the right.

Removal

1. Peel back the frosted liner from one side of the precut VHB strip. Press the small end of the keycap lever onto the 1x.5 adhesive and hold for 10 seconds.



2. Lift the keycap lever, with the adhesive attached, from the clear liner.

3. Lightly press the keycap lever with the adhesive side down onto the key. **Important:** The arrow on the lever must always point to the hinged side of the keycap so the lever is always tilting away from the snaps and toward the hinge. Refer to the Scissor Map above for the location of the snaps.

4. Hold for 10 seconds to activate the adhesive.

Note: The adhesive is very strong. If the keycap lever is accidentally placed onto the wrong keycap, continue with the removal process and replace with a new keycap.



5. Push the lever tool towards the arrow and lift up just until you hear a snap. **Caution:** Be sure not to tilt the keycap more than 20 degrees. Doing so could cause the scissor mechanism to become damaged.



6. Push toward the left to release the keycap from the hinges (1). Lift up to remove the keycap (2).

7. Remove the keycap and the adhesive from the keycap lever and discard both. **Note:** The adhesive is one-time use only and needs to be replaced for every keycap removal.

Reassembly

Important: Always replace the removed keycap with a new one. Do not reuse keycaps.

1. Use a black stick to lift the scissor slightly. Insert the hinged side of the keycap into the well at a 15-degree angle and then slide the key back toward the snap to engage the hinge. **Note:** This process is unique to the arrow keys and the Escape key.



2. Gently push down on the top of the keycap to engage the snaps.

3. Tap the key repeatedly to verify that it springs back each time. Compare the response of the new keycap with the response of the keycaps around it.

4. If the keycap does not appear to be correctly installed, start again at removal step one with a new keycap.

C. Removing and Replacing Link Bar Keys (Space Bar, Tab, Return, Shift, Delete, and Caps Lock)

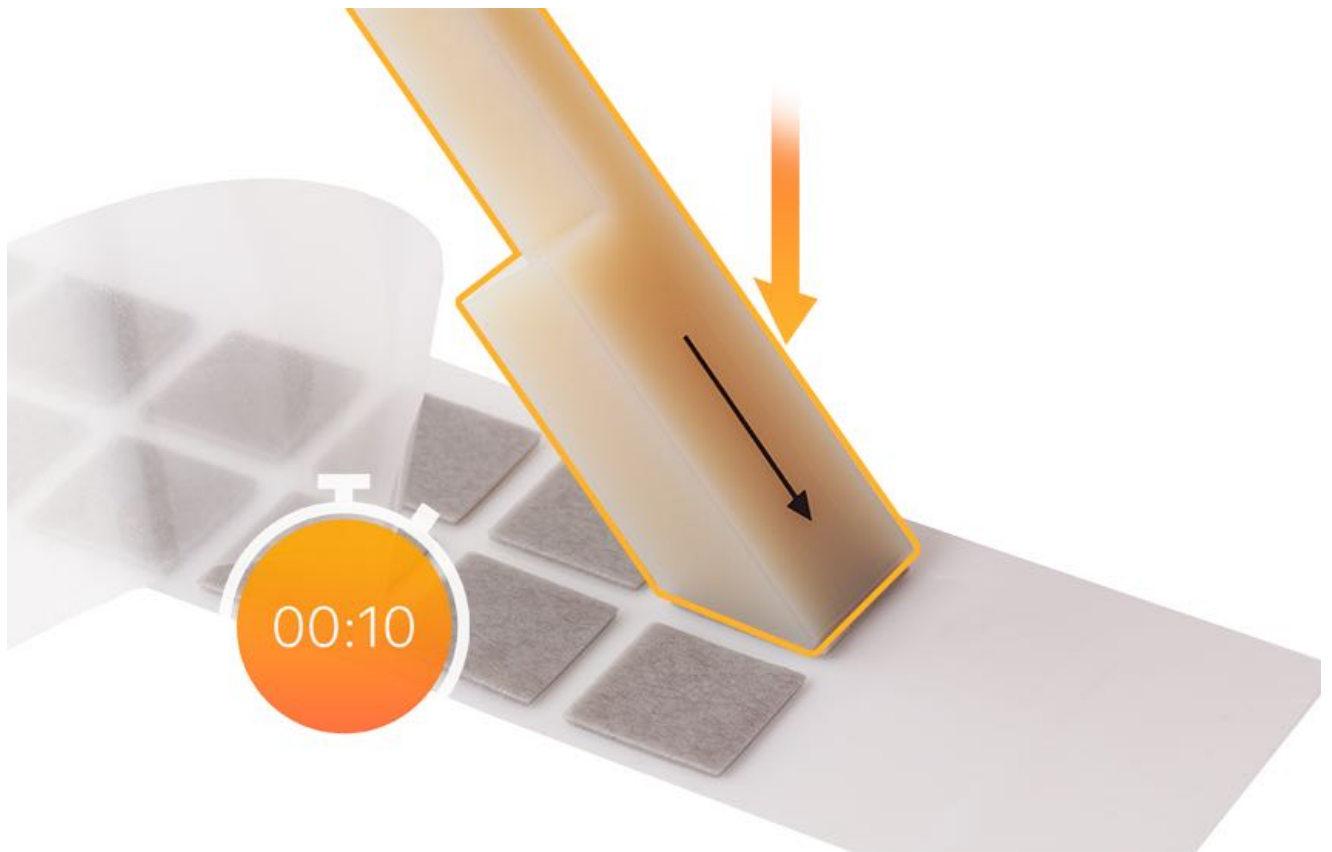
Note:

- For keys with two hinges and two snaps, use two keycap lever tools. Refer to the scissor map.
- Space bar, tab, return, shift, delete, and Caps Lock keys have link bars. The process for keys with link bars is the same. Refer to the scissor map for the link bar locations.

Removal

1. Align the lever tool over each set of scissors. Refer to the scissor map for correct placement.

2. Peel back the frosted liner from one side of the precut VHB strip. Press the large end of one the keycap lever onto the 1x1 adhesive and hold for 10 seconds. Repeat for the second lever.



3. Lift the keycap levers, with the adhesive attached, from the clear liner.

4. Lightly press the keycap lever with the adhesive side down onto the key. **Important:** The arrows on the levers must always point to the hinged side of the keycap so the levers are always tilting away from the snaps and toward the hinge. Refer to the Scissor Map above for the location of the snaps.

5. Hold for 10 seconds to activate the adhesive. **Note:** The adhesive is very strong. If the keycap lever is accidentally placed onto the wrong keycap, continue with the removal process and replace with a new keycap.



6. Simultaneously lift both levers in the direction of the arrow until you hear the snaps release. Then lift the keycap off of the keyboard. **Note:** The bottom link bar on larger keys might stick to the keycap during removal. If so, use a black stick to unsnap it so it stays in the keycap well.



7. Once the keycap has been removed, use a black stick to carefully and gently lift each scissor up and down to check that they move easily and lie flat when released. For easier inspection, turn on the keyboard backlight to illuminate the scissors.

8. Use compressed air to clean the well. **Note:** If compressed air does not dislodge visible debris, use a clean cloth to gently dislodge the debris.

9. Remove the keycap and the adhesive from the keycap lever and discard both. Note: The adhesive is one-time use only and must be replaced for every keycap removal.

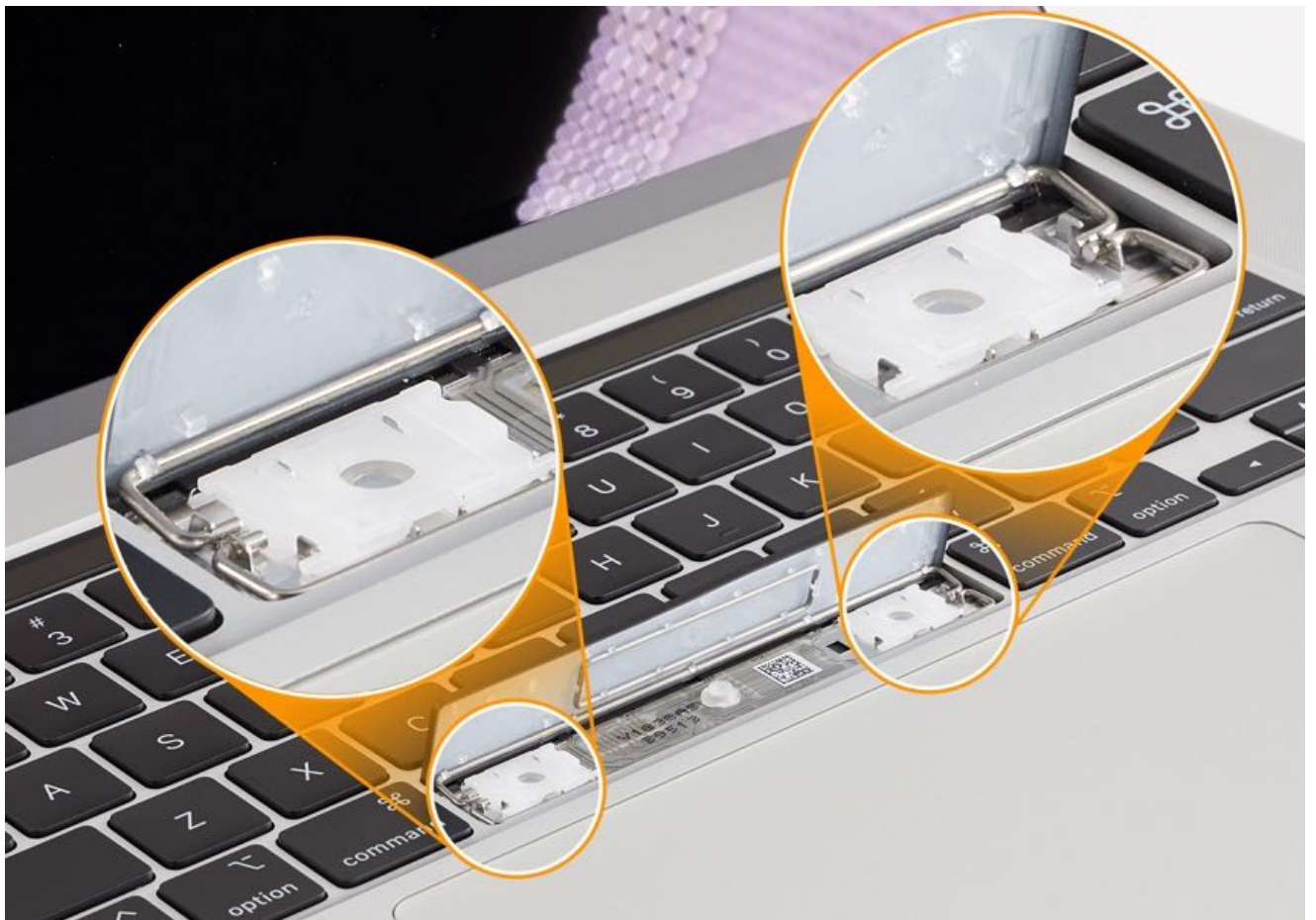
Reassembly

Important: Always replace the keycap with a new one. Do not reuse keycaps.

1. Check that the hinge bar is preinstalled on the replacement keycap. The snap bar remains in the top case.



2. Position the keycap at a 15-degree angle and insert the top link bar into the metal hooks located on each side of the well.



3. Push the key forward to set the bar in place. Then gently push down on the four snaps to engage the keycap.



4. If the keycap does not appear to be correctly installed, start again at removal step one with a new keycap.

D. Replacing Scissors

Important:

- Only remove the scissor if the scissor is damaged. Be sure to replace it with the correct type of scissor. Refer to the scissor map to find the correct scissor.
- Be sure to take note of the correct orientation of the scissor. This will be important for reassembly.

1. Use a black stick to disengage the scissor pins from the metal hooks.



2. Once the pins are disengaged, use tweezers to lift the scissor out of the well.



Reassembly

Important:

- Before installing a new scissor, check the scissor map to ensure you are installing the correct one.
- Be sure the scissor is installed in the correct orientation.

1. Use compressed air to clean the keycap well. **Note:** If compressed air does not dislodge visible debris, use a black stick to gently dislodge the debris.

2. Use tweezers to align the scissor in the well and engage the upper hooks.



3. Engage the scissor pins with the lower hooks with your finger or a black stick. When engaged the pins should look like number 1. Number 2 shows the pin not engaged.



4. Once the scissor has been installed, use a black stick to carefully and gently lift the scissor up and down to check that it moves easily and lies flat when released. For easier inspection, turn on the keyboard backlight to illuminate the scissor.

Visual/Mechanical Inspection (VMI) Guide for Mac Computers - Table of Contents

Visual/Mechanical Inspection (VMI) Guide for Mac Computers - Table of Contents

- [Mac Displays](#)
- [Liquid Damage](#)
- [Power Adapters](#)
- [USB-C Cables](#)

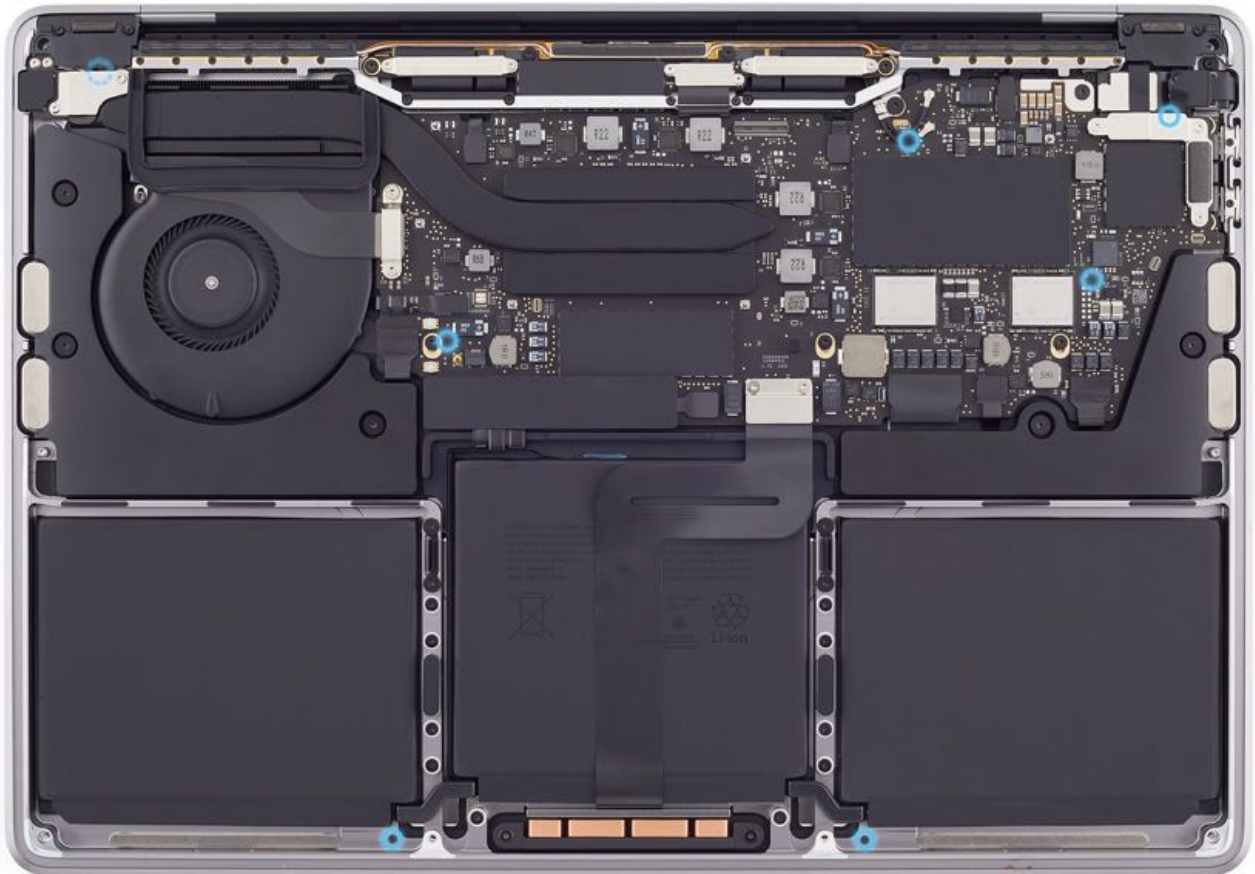
MacBook Pro (13-inch, 2020, Two Thunderbolt 3 Ports) Liquid Contact Indicators

Liquid Contact Indicators for MacBook Pro (13-inch, 2020, Two Thunderbolt 3 Ports)

Liquid Contact Indicators (LCIs) help determine if a computer has been exposed to liquid. Represented by [small black \(Ultraviolet LCIs\) dots](#), LCIs change color when they come in contact with liquid, such as an accidental spill.

Important: An LCI is a tool that helps technicians identify if a product has been in contact with liquid. Technicians should not rely solely on this tool, but should perform a thorough examination for signs of liquid contact, such as corrosion.

- The dotted circle in the top left corner represents a UV LCI that is visible under the Touch ID board cowling.



How to Read Liquid Contact Indicators with Ultraviolet (UV) Light

How to Read Liquid Contact Indicators with Ultraviolet (UV) Light

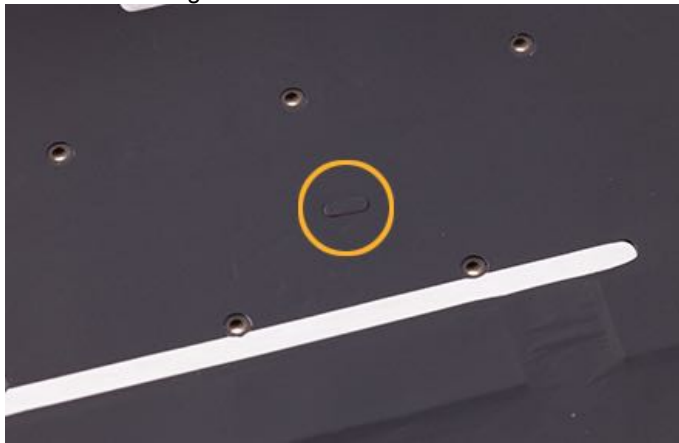
MacBook (Retina, 12-inch, 2017), MacBook Air (Retina, 13-inch, 2018 and 2019), and MacBook Pro (2018, 2019, and 2020) contain spill sensors called liquid contact indicators (LCIs). LCIs help discover accidental damage to the computer. They are black, and liquid contact is only visible with the use of a UV light. LCIs appear black under normal light and glow blue when highlighted with a UV light. They turn pink or produce a pink halo when they come in contact with liquid.

Note: MacBook Pro (15-inch, 2018 and 2019) also has one LCI that appears white and turns pink when it comes in contact with liquid. Refer to [Liquid Contact Indicators](#).

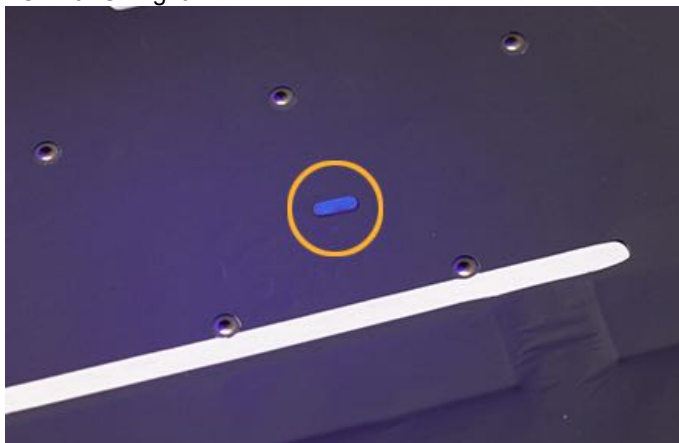
Important: A triggered LCI is not the only evidence of liquid contact. Be sure to inspect for corrosion or liquid residue during a quick check or repair. Refer to [Visual/Mechanical Inspection \(VMI\) Guide for Mac Liquid Damage](#) for instructions on how to inspect for liquid damage.

No Liquid Contact:

- LCI without UV light



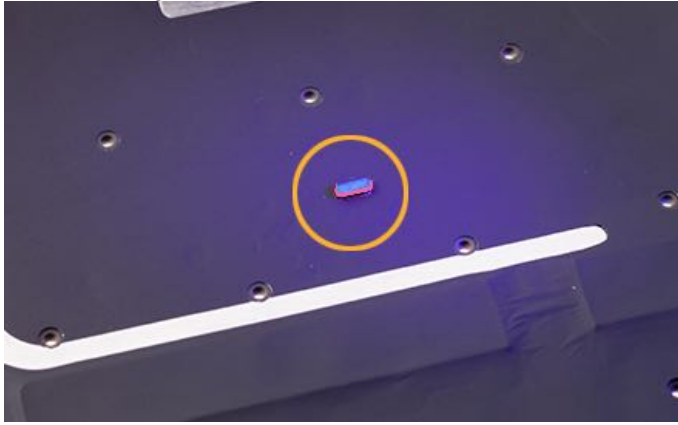
- LCI with UV light



Liquid Contact:

- LCI without UV light

-
- LCI with UV light



Safety Information:

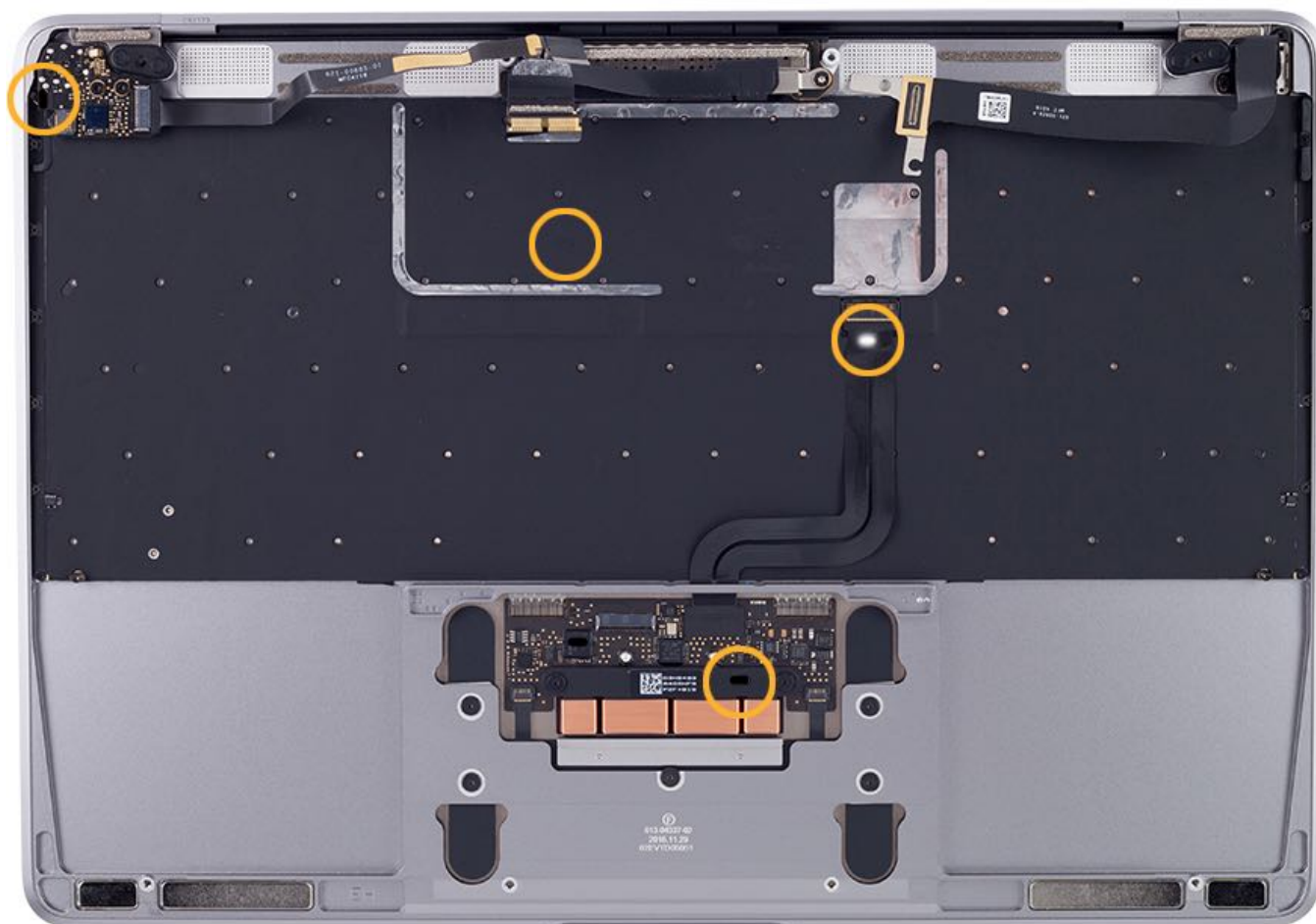
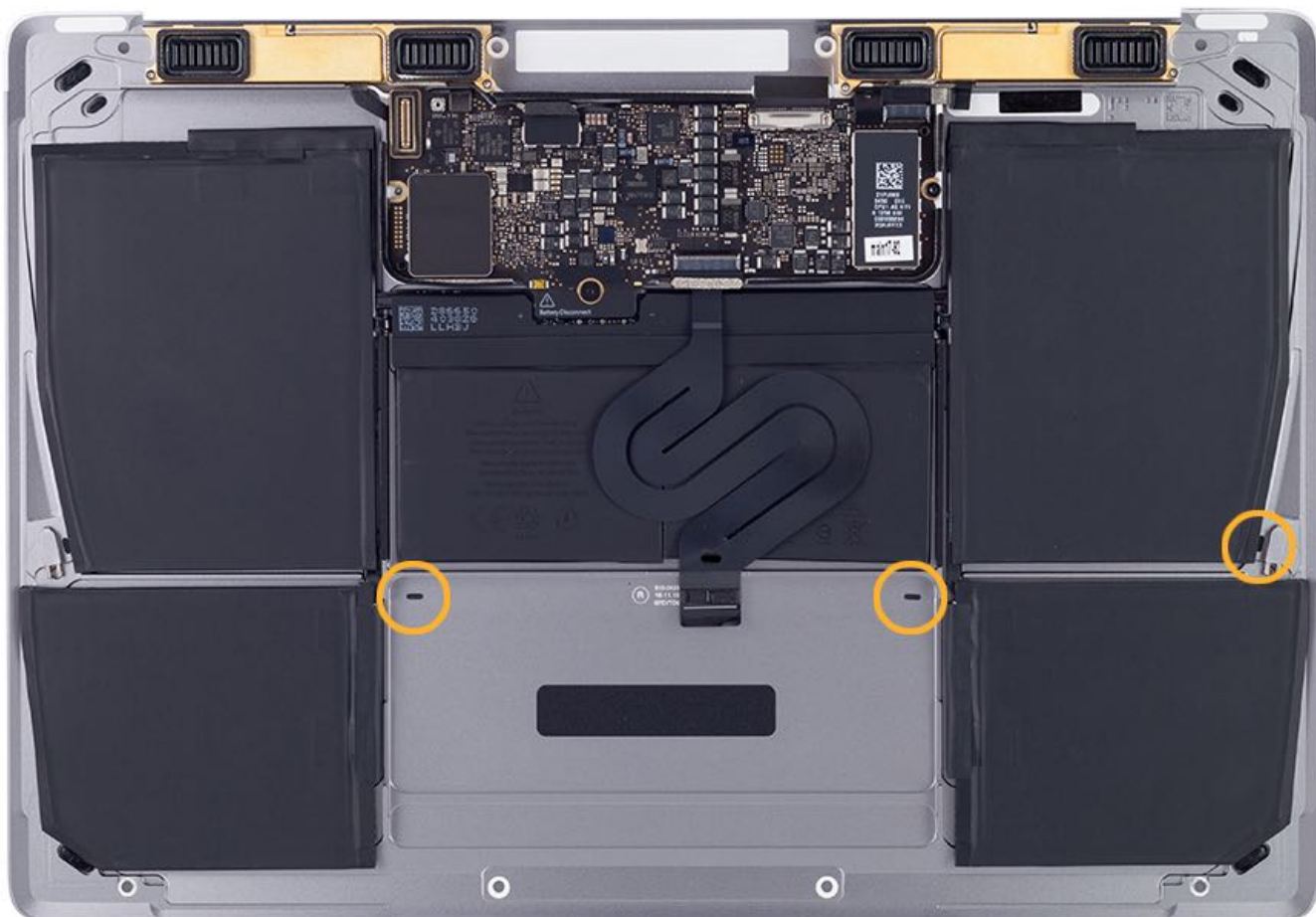
Caution: UV LCIs illuminate with the use of the Apple-approved UV light (923-01604). Follow safety precautions when using this tool:

- Do not remove the warning labels on the UV light.



- Do not shine the UV light in anyone's eyes or face.
- Avoid repeated exposure to the UV light.
- If a different UV light is used, safety glasses and gloves must be worn to avoid excessive exposure.

The following images show the general location of LCIs in a MacBook computer.



Procedure

Note:

- Ultraviolet LCIs are black. The black LCIs blend in with the rest of the computer. When in contact with liquid, the LCIs may swell and become easier to identify.
- When using the UV light, hold it 12 to 14 inches (30 to 35 centimeters) from the computer and shine it at an angle of 15 to 75 degrees.



Warning: While the UV light is shining, do not hold it close to your face or bend your head down to look closely at the LCIs.



1. Press the power button on the UV light.



2. Check the color of the LCI. Blue indicates an LCI that has not been triggered. A pink LCI or a pink halo around the LCI indicates that it has been triggered. Refer to visual examples at the top of this article.

LCD Pixel Anomalies

When displaying a single color over the screen area, the liquid crystal display (LCD) might show one or more pixels that are not properly lit.

LCD technology uses rows and columns of addressable points (pixels) that render text and images on the screen. Each pixel has three separate subpixels (red, green, and blue) that allow an image to render in full color. Each subpixel has a corresponding transistor responsible for turning the subpixel on and off.

Depending on the display size, there can be thousands or millions of subpixels on an LCD. For example, the LCD used in iMac (27-inch, Late 2013) has a display resolution of 2560 by 1440, which means there are 3.7 million pixels. Each pixel is made up of a red, a green, and a blue subpixel, resulting in over 11 million individual picture elements on the 27-inch display. Occasionally, a transistor may not work perfectly, resulting in the affected subpixel remaining off (dark) or on (bright). With the millions of subpixels on a display, it is possible to have a low number of such transistors on an LCD. In some cases, a small piece of dust or other foreign material may appear to be a pixel anomaly. Apple strives to use the highest-quality LCD displays in its products, but pixel anomalies can occur in a small percentage of them.

In some cases, pixel anomalies are caused by a piece of foreign material that is trapped inside the display or on the surface of the display or glass panel. Foreign material is typically irregular in shape and is usually most noticeable when viewed against a white background.

- For any computer, foreign material on the surface of the display or glass panel can easily be removed using a lint-free cloth.
- For any computer, foreign material trapped inside the display can only be resolved by replacing the entire display assembly.

General Troubleshooting

Update Software and Firmware

First ensure that the correct version of macOS is installed on the computer, and check for and apply the latest software and firmware updates. If the computer has an incompatible Mac operating system, it might not finish starting up, display a prohibitory symbol at startup, or behave in other unexpected ways. [Determine if the computer has an incompatible Mac operating system](#) , and update to a compatible one.

Firmware is software that's written into memory circuits like flash memory, which holds the software code indefinitely.

To update firmware on an Intel-based Mac computer without an Apple T2 Security Chip, connect the computer to the internet, choose Apple menu > About This Mac, then click Software Update.

For Mac computers with an Apple T2 Security Chip, system management controller (SMC) and extensible firmware interface (EFI) updates are installed as part of macOS software update.

When the firmware is restored on a Mac that contains an Apple T2 Security Chip, the firmware on the Apple T2 Security Chip and on any volumes on your internal flash storage is also restored. When this process is complete, any data on any flash storage volumes is unrecoverable.

When a Mac is running a beta version of a new macOS, the firmware installed on the Mac is newer than the firmware supported in AST 2 diagnostics. Therefore computers running macOS beta software must be downgraded before performing any hardware repair.

Quick Check Procedures

Resetting the System Management Controller

[Reset the System Management Controller \(SMC\)](#) If the computer has the following issues:

- The computer doesn't start up, doesn't display video, has sleep or fan noise issues, or other power issues.
- [The fans run at full speed](#) when you press the power button while inserting the power cord in an iMac (2019 and earlier) with an Apple T2 Security Chip.

Resetting Nonvolatile RAM

[Reset the Nonvolatile RAM \(NVRAM\)](#) if the computer has the following issues:

- Issues related to settings that can be stored in NVRAM
- Volume, display resolution, startup-disk selection, time zone, and recent kernel panic information
- The computer starts up from a disk other than the one selected in Startup Disk preferences.
- A questions mark icon briefly appears before the computer starts up.

The settings stored in the computer's NVRAM vary depending on the type of computer, connected devices, and drives.

Starting Up in Safe Mode

[Start the computer in safe mode](#) for the following reasons:

- To perform certain checks and prevent some software from automatically loading or opening
- To resolve or isolate certain issues on the startup disk

Device Firmware Update Mode

If the computer is unresponsive, put it in [Device Firmware Update \(DFU\) mode](#) Then you can attempt to revive or restore the computer's firmware in [Apple Configurator 2](#) .

Recovering a Lost Firmware Password

Only technicians at Apple Stores or Apple Authorized Service Providers can unlock the following Mac models when they are protected by a firmware password:

- iMac (Mid 2011) and later
- iMac Pro (2017)
- MacBook (Retina, 12-inch, Early 2015) and later
- MacBook Air (Late 2010) and later
- MacBook Pro (Early 2011) and later
- Mac mini (Mid 2011) and later
- Mac Pro (Late 2013)

Sleep Status Tips

Sleep Status Tips for MacBook (Retina, 12-inch, Early 2015 and later) and MacBook Pro (2016 and 2017)

These computer models do not have a sleep indicator light. To troubleshoot without one:

- Press and hold the Caps Lock key to wake the computer from sleep. The Caps Lock indicator light is a good indication of power.
- Check the haptic response of the trackpad. The trackpad will not have any haptic response when there is no power to the system.
- Open the display and press an alphanumeric key to wake the computer from sleep.
- A computer that has been in sleep mode for an extended period can consume the remaining battery charge. Restore power to the computer with a known-good power adapter. The computer will start up from a hibernation file and start up from where it left off.
- Use a USB-C to USB Adapter, USB-C Digital AV Multiport Adapter, or USB-C VGA Multiport Adapter to connect a USB device that has a power-on or activity indicator light. As power is restored to the USB and the computer wakes from sleep, the indicator light illuminates.
Note: A USB-C to USB adapter may be used if power does not need to be supplied to the computer.
- Resetting the System Management Controller (SMC) instantly shuts down the computer, with some side effects:
 - If the computer is in sleep mode, it will start up from a hibernation file.
 - If the computer is running OS X or macOS during the SMC reset, data from open applications can be lost.
 - If the computer is already shutdown, there will be no side effects.

MacBook Air (Retina, 13-inch, 2018 and later), and MacBook Pro (2018 and later)

The troubleshooting steps listed above still apply for these computer models. Pressing any key or the trackpad, connecting to a power adapter, and opening the display will also start these computer models. Note the following behaviors when the computer is shutdown and the battery has some remaining charge:

- The Caps Lock indicator light may illuminate when pressed.
- The trackpad will provide a haptic response when pressed.
- The computer will start up when the display is opened.
- The computer will start up when the display is open and it is connected to a power adapter.

MacBook Pro (16-inch, 2019)

- This computer model has a magnet on the left display clutch that regulates its sleep. If the MacBook Pro (16-inch, 2019) is not sleeping, check that the magnet is present. If the magnet is not present, the display assembly will need to be replaced. [Display Assembly](#).

Diagnostic Software

Apple Service Toolkit 2 (AST 2)

AST 2 is a cloud-based diagnostic system that helps technicians triage and verify repairs for iOS devices and Mac computers released in June 2014 and later, except for MacBook Pro (Retina, Mid 2014). Technicians use AST 2 to initiate diagnostics wirelessly on a user's device using the Diagnostic Console (a web application on a Mac or iPad). Technicians can also view diagnostic results on the Diagnostic Console.

For computers with the Apple T2 Security Chip, System Configuration (found in AST 2) must be run after certain repairs for the repair to be complete. Failure to do so will result in an inoperative system and an incomplete repair. Refer to [System Configuration for Macs with the Apple T2 Security Chip](#) for more information.

An MRI (OS) diagnostic suite is available only for Mac notebook computers with the Apple T2 Security Chip.

Apple Diagnostics

Apple Diagnostics is a customer-facing software tool that is built into all Mac computers released in June 2013 and later.

AST 2 MRI (OS) suite for Mac notebook computers with the Apple T2 Security Chip

This article provides information about and when to use AST 2 Mac Resource Inspector (MRI) OS for Mac notebook computers with the Apple T2 Security Chip.

Information

An MRI (OS) diagnostic suite is now available only for Mac notebook computers with the Apple T2 Security Chip, which includes these models:

MacBook Air

- MacBook Air (Retina, 13-inch, 2018)
- MacBook Air (Retina, 13-inch, 2019)
- MacBook Air (Retina, 13-inch, 2020)

MacBook Pro (13-inch)

- MacBook Pro (13-inch, 2019, Two Thunderbolt 3 Ports)
- MacBook Pro (13-inch, 2020, Two Thunderbolt 3 Ports)
- MacBook Pro (13-inch, 2018, Four Thunderbolt 3 Ports)
- MacBook Pro (13-inch, 2019, Four Thunderbolt 3 Ports)
- MacBook Pro (13-inch, 2020, Four Thunderbolt 3 Ports)

MacBook Pro (15-inch)

- MacBook Pro (15-inch, 2018)
- MacBook Pro (15-inch, 2019)

MacBook Pro (16-inch)

- MacBook Pro (16-inch, 2019)

The Apple T2 Security Chip inside these computers controls the following components which require a known-good macOS with which to test:

- Audio
- Camera
- Flash Storage
- Power Management
- Secure element
- Touch ID
- Trackpad
- Lid Angle Sensor (LAS) on MacBook Pro (16-inch, 2019)

MRI (OS) uses a known-good macOS to check for the presence of T2-related hardware components on these computers.

Mac notebook computers with the Apple T2 Security Chip will continue to display MRI (EFI) as an available diagnostic suite, and will have an additional selection of MRI (OS) on the AST 2 Diagnostic Console.

MRI (OS) will only be available as a choice within the Diagnostic Console for Mac notebook computers with the Apple T2 Security Chip. This suite is not available or needed for any other Mac models.

All other Mac notebook and desktop computers that are supported by AST 2 should continue to use MRI (EFI).

9:41 AM 100%

diagnostics.apple.com

AST 2 Diagnostic Console Jane

Diagnostic Suites

TRIAGE

Mac Resource Inspector (EFI)

Quick triage tool that checks for the presence of hardware components and performs a series of short tests to verify hardware functionality using EFI.

Suggested use: during triage to provide a quick health check of hardware that can be tested using EFI.

Show Less...

3-5 minutes

Mac Resource Inspector (OS)

Triage tool that checks for the presence of T2-related hardware components that require an OS to test. Refer to GSX article TP1748 for more information.

Suggested use: during triage of components that require an OS to test such as ambient light sensor, audio, bluetooth, camera, trackpad, and Touch ID.

Show Less...

6-8 minutes

Storage (OS)

Important: The MRI (OS) suite requires up to eight minutes to complete under normal network conditions.

When to use the MRI (OS) diagnostic suite

Mac notebook computers with the Apple T2 Security Chip may require running tests only available from within macOS.

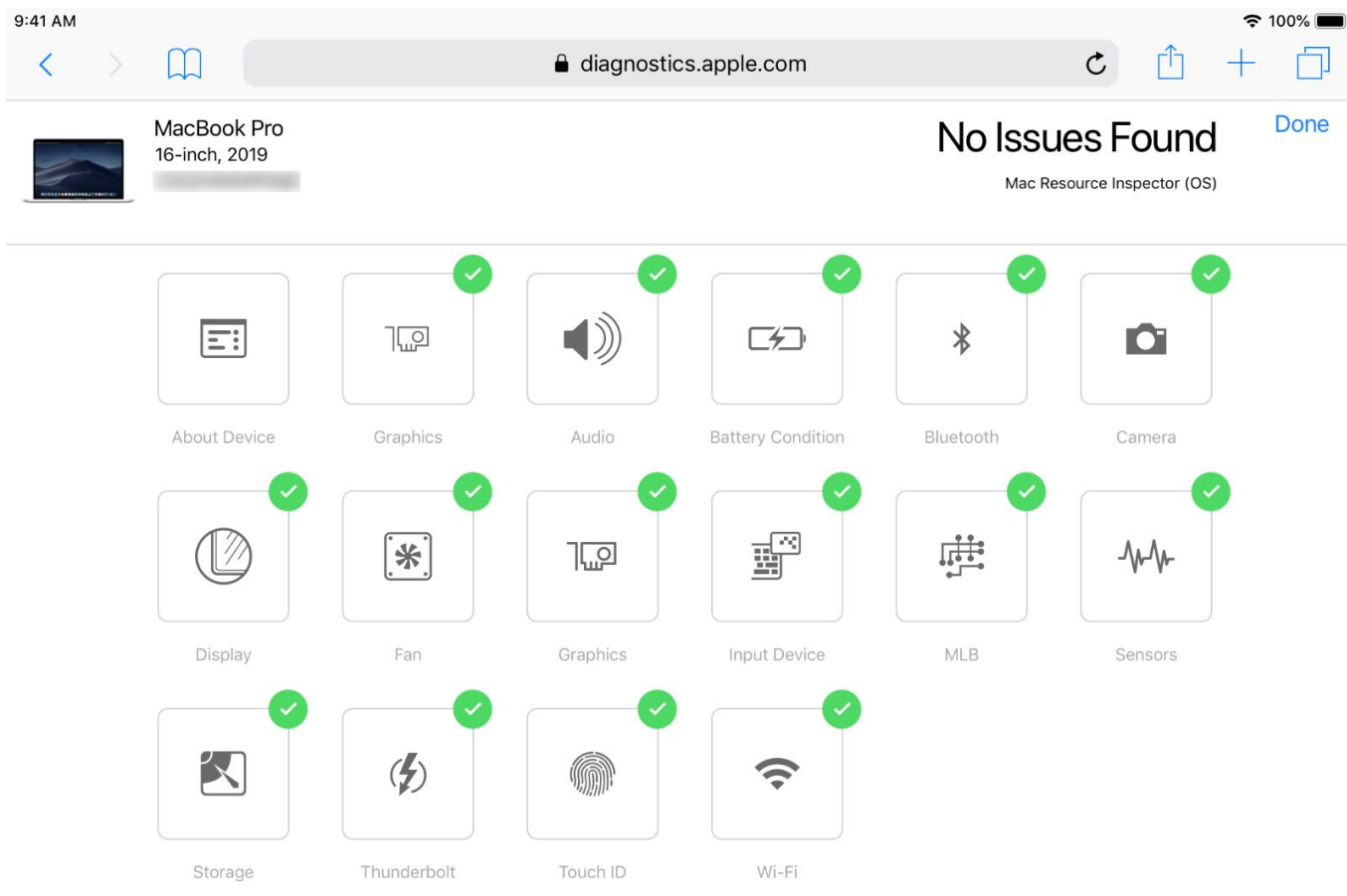
MRI (OS) is required instead of MRI (EFI) when the user reports any issue with a Mac notebook computer with the Apple T2 Security Chip that involves any T2-related components.

These tests are only available in MRI (OS):

- Ambient Light Sensor (ALS)
- Audio
- Bluetooth
- Camera
- Input device (built-in trackpad)
- Touch ID
- Lid Angle Sensor (LAS) presence for MacBook Pro (16-inch, 2019)

The MRI (OS) diagnostic suite also includes many of the same tests as the MRI (EFI) diagnostic suite, so in most cases you would not need to run both suites on Mac notebook computers with the Apple T2 Security Chip.

For example, the Battery, Fan, and Sensor tests exist in both MRI (EFI) and MRI (OS) because the other tests depend on these critical components. Graphics, Logic Board, Storage, Thunderbolt, and Wi-Fi tests take just a few seconds to run, so these are included in both MRI (EFI) and MRI (OS). These EFI and OS tests are functionally the same, so you do not need to run these tests in both EFI and OS.



Note: The screen shot above shows the available tests within MRI (OS) for MacBook Pro (16-inch, 2019); available tests for other models may vary.

During triage and before repair: MRI (OS) can be used to verify the presence of T2-related hardware components inside a Mac notebook computer with the Apple T2 Security Chip.

Run MRI (OS) to detect the presence of T2-related components for the following parts:

- MacBook Air (Retina, 13-inch, 2018):
 - Logic board
 - Touch ID board
- MacBook Air (Retina, 13-inch, 2019 and 2020):
 - Display assembly
 - Logic board
 - Touch ID board
- MacBook Pro (13-inch, 2019 and 2020, Two Thunderbolt 3 Ports), MacBook Pro (13-inch, 2018, 2019, and 2020, Four Thunderbolt 3 Ports), and MacBook Pro (15-inch, 2018 and 2019):
 - Display assembly
 - Logic board
 - Top case assembly
 - Touch ID board
- MacBook Pro (16-inch, 2019):
 - Display assembly
 - Logic board
 - Top case assembly
 - Touch ID board
 - Lid Angle Sensor (LAS)

After reassembly: For the parts listed above, you must also run the System Configuration repair completion suite.

After repair: For all hardware repairs, run Full System Diagnostic (OS) and Full System Diagnostic (EFI) suites to complete system testing of all hardware components after repair. The Full System Diagnostic suites also include all relevant tests

within MRI (OS), so you do not need to run MRI (OS) again.

When to use the MRI (EFI) diagnostic suite

Some tests are only available in MRI (EFI) and are not available in MRI (OS).

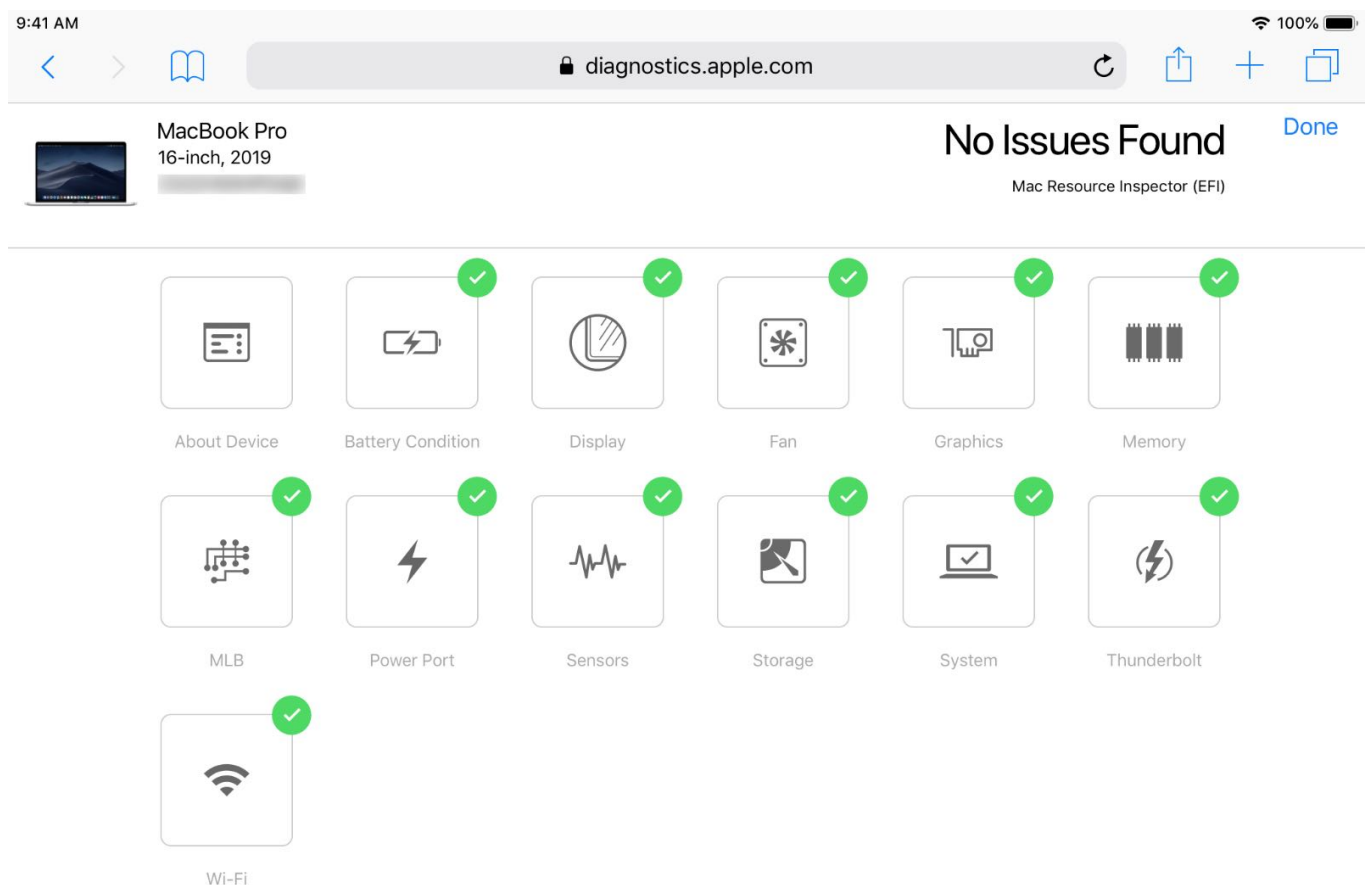
The following tests are only available in MRI (EFI):

- Memory
- Power Port
- System

The following tests are present in both MRI (EFI) and MRI (OS):

- About device
- Battery condition
- Display
- Fan
- Graphics
- MLB
- Sensors
- Storage
- Thunderbolt
- Wi-Fi

These tests are functionally the same, so you only need to run these tests from either MRI (EFI) or MRI (OS). You do not need to run these tests from both environments.



Note: The screen shot above shows the available tests within MRI (EFI) for MacBook Pro (16-inch, 2019); available tests for other models may vary.

MRI (EFI) is recommended instead of MRI (OS) in the following circumstances:

- When the user reports any issue that involves testing memory, the power port, or the presence of the recovery partition.

- When the user reports any issue with a Mac desktop or notebook computer other than a Mac notebook computer with the Apple T2 Security Chip.
-

Troubleshooting

If AST 2 MRI (OS) is not listed as an available diagnostic suite to run in your AST 2 Diagnostic Console, check the following:

- Verify that the UUT is a Mac notebook computer with the Apple T2 Security Chip.
- The AST 2 Diagnostic Console will only display applicable diagnostic suites for a UUT.

If AST 2 MRI (OS) is an available diagnostic suite to run on your AST 2 Diagnostic Console, but the UUT is having trouble connecting to AST 2, check the following:

Verify that your service location's AST 2 Diagnostic Server Gateway Mac is running.

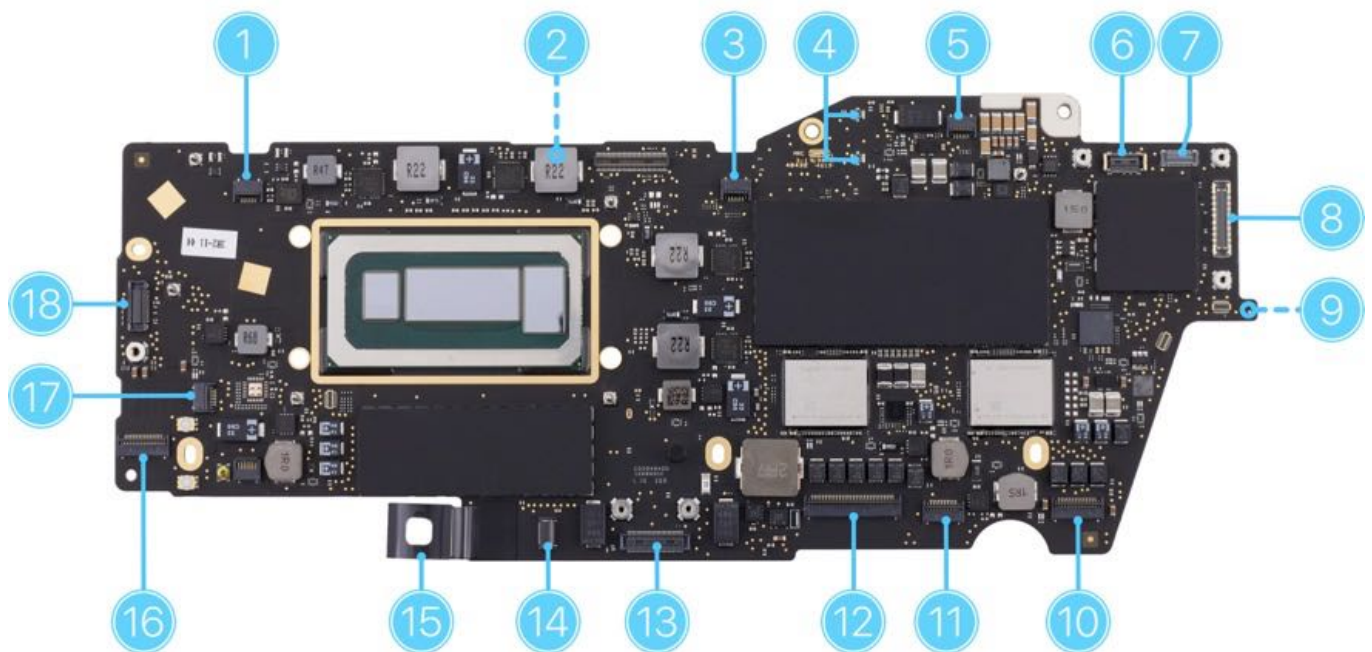
Verify that your service location's AST 2 Diagnostic Server Gateway Mac has the latest AST 2 diagnostic OS images and tools installed and configured.

Verify that the UUT is connected to the same LAN as your service location's AST 2 Diagnostic Gateway Server Mac.

MacBook Pro (13-inch, 2020, Two Thunderbolt 3 Ports) Functional Overview

Functional Overview for MacBook Pro (13-inch, 2020, Two Thunderbolt 3 Ports)

Refer to the diagrams for symptoms related to logic board and audio board flex assembly connectors.



1 = Keyboard Backlight (Right)

- No keyboard backlight
- Partial keyboard backlight

2 = Embedded DisplayPort (eDP) (also carries FaceTime HD camera & Ambient Light Sensor signals)

- No video, blurred, distorted, or monochrome video on display
- No display backlight
- Display does not dim in low light conditions
- Keyboard backlight cannot be enabled
- Camera does not function

3 = Keyboard Backlight (Left)

- No keyboard backlight
- Partial keyboard backlight

4 = Wi-Fi and Bluetooth Antenna

- No/poor Wi-Fi reception
- Drops Wi-Fi connection
- Does not pair with Bluetooth devices
- Drops Bluetooth connection

5 = Tri-Mic

- No microphone audio input (with Internal Microphone selected in Sound Input Preferences)
- Distorted microphone audio input

6 = Touch Bar Touch

- No touch response on Touch Bar

7 = Touch Bar Display

- No video, blurred, distorted, or monochrome video on Touch Bar display

8 = I/O Board

- No power
- No battery charge
- Power adapter issues
- USB connectivity issues
- USB power issues
- No video to external display
- No audio to external display speakers
- Thunderbolt device not found
- Thunderbolt controller not recognized
- Thunderbolt driver issues
- Thunderbolt power issues

9 = Left Hall Effect (Sleep Sensor)

- No sleep when display closed
- No video to internal display, but video to external display if one is connected (sensor stuck)

10 = Left Speaker

- No audio from left speaker
- Distorted audio from left speaker

11 = Keyboard Backlight (Power)

- No keyboard backlight
- Partial keyboard backlight

12 = Keyboard

- Non-responsive keys

13 = Trackpad

- No Multi-Touch or cursor movement from built-in trackpad
- No click action from built-in trackpad

14 = Battery Management Unit (BMU) Signal Cable

- No power
- Not charging (verify with correct model of power adapter)
- X symbol for battery in menu bar

15 = BMU Power and BMU Interconnect Screw

- No power
- Not charging (verify with correct model of power adapter)
- X symbol for battery in menu bar

16 = Right Speaker

- No audio from right speaker
- Distorted audio from right speaker

17 = Fan

- System noise
- Fan not running
- Intermittent shutdown

18 and 19 = Audio Board Flex Assembly (carries signals for audio jack, Touch ID, right Hall effect (sleep) sensor, and power button)

Note: The audio board flex assembly connector on the logic board (18) is shown in the image above, while the audio board flex assembly cable (19) is shown in the image below.

- No sleep when display closed
- No video to internal display, but video to external display if one is connected (sensor stuck)
- No external audio input
- No headphone audio output
- No headset controls or mic input
- Will not turn on from power button
- Will not authenticate using Touch ID



20 = Right Hall Effect (Sleep Sensor)

- No sleep when display closed
- No video to internal display, but video to external display if one is connected (sensor stuck)

21 = Audio Jack

- No external audio input
- No headphone audio output
- No headset controls or mic input

22 = Touch ID Board

- Will not turn on from power button
- Will not authenticate using Touch ID

Use this table to see which products your ACiT certification covers. A checkmark indicates that the product is covered by the ACiT exam listed at the top of the table. If your ACiT certification doesn't cover the product, you must complete the corresponding learning track listed in the table to be certified for that product.

Products covered under ACiT Certifications:

Product	ACiT 2016	ACiT 2017	ACiT 2018	ACiT 2019
iPhone 5s	√	√	√	√
iPhone 5c	√	√	√	√
iPhone 6 and iPhone 6 Plus	√	√	√	√
iPhone 6s and iPhone 6s Plus	√	√	√	√
iPhone SE	√	√	√	√
iPhone 7 and iPhone 7 Plus	<i>iPhone 7 and iPhone 7 Plus Learning Track</i>	√	√	√
iPhone 8 and iPhone 8 Plus	<i>iPhone 8 and iPhone 8 Plus Learning Track</i>		√	√
iPhone X	<i>iPhone X Models Learning Track</i>			√
iPhone XR				√
iPhone XS and iPhone XS Max				√
iPhone 11	<i>iPhone 11 Learning Track</i>			
iPhone 11 Pro and iPhone 11 Pro Max	<i>iPhone 11 Pro Learning Track</i>			
iPhone SE (2nd Generation)	iPhone SE (2nd Generation) Learning Track			

ACMT Certifications 2019

Use this table to see which products your ACMT certification covers. A checkmark indicates that the product is covered by the ACMT exam listed at the top of the table. If your ACMT certification doesn't cover the product, you must complete the corresponding learning track listed in the table to be certified for that product.

Products covered under ACMT Certifications:

MacBook Pro (13-inch models)	ACMT	ACMT 2015	ACMT 2016	ACMT 2017	ACMT 2018	ACMT 2019
MacBook Pro (13-inch, Mid 2012)	√	√	√	√	√	√
MacBook Pro (13-inch, Early 2013)	√	√	√	√	√	√
MacBook Pro (Retina, 13-inch, Late 2013)	√	√	√	√	√	√
MacBook Pro (Retina, 13-inch, Mid 2014)		√	√	√	√	√
MacBook Pro (Retina, 13-inch, Early 2015)				√	√	√
MacBook Pro (13-inch, 2016, Two Thunderbolt 3 Ports)				√	√	√
MacBook Pro (13-inch, 2016, Four Thunderbolt 3 Ports)				√	√	√
MacBook Pro (13-inch, 2017, Two Thunderbolt 3 Ports)	MacBook Pro 13-inch Learning Track				√	√
MacBook Pro (13-inch, 2017, Four Thunderbolt 3 Ports)					√	√
MacBook Pro (13-inch, 2018, Four Thunderbolt 3 Ports)						√
MacBook Pro (13-inch, 2019, Two Thunderbolt 3 Ports)						
MacBook Pro (13-inch, 2019, Four Thunderbolt 3 Ports)						
MacBook Pro (13-inch, 2020, Two Thunderbolt 3 Ports)	2020 MacBook Pro 13-inch Learning Track and MacBook Air 2020 Learning Track					
MacBook Pro (13-inch, 2020, Four Thunderbolt 3 Ports)						

MacBook Pro (15-inch models)	ACMT	ACMT 2015	ACMT 2016	ACMT 2017	ACMT 2018	ACMT 2019
MacBook Pro (Retina, 15-inch, Early 2013)	√	√	√	√	√	√
MacBook Pro (Retina, 15-inch, Late 2013)	√	√	√	√	√	√
MacBook Pro (Retina, 15-inch, Mid 2014)		√	√	√	√	√
MacBook Pro (15-inch, Mid 2015)				√	√	√
MacBook Pro (15-inch, 2016)				√	√	√
MacBook Pro (15-inch, 2017)	MacBook Pro 15-inch Learning Track				√	√
MacBook Pro (15-inch, 2018)						√
MacBook Pro (15-inch, 2019)						

MacBook Pro (16-inch)	ACMT	ACMT 2015	ACMT 2016	ACMT 2017	ACMT 2018	ACMT 2019
MacBook Pro (16-inch, 2019)	MacBook Pro 16-inch Learning Track					

MacBook Air (all models)	ACMT	ACMT 2015	ACMT 2016	ACMT 2017	ACMT 2018	ACMT 2019
MacBook Air (11-inch, Mid 2013)	√	√	√	√	√	√
MacBook Air (11-inch, Early 2014)	√	√	√	√	√	√
MacBook Air (11-inch, Early 2015)	√	√	√	√	√	√
MacBook Air (13-inch, Mid 2013)	√			√	√	√
MacBook Air (13-inch, Early 2014)	√			√	√	√
MacBook Air (13-inch, Early 2015)	√			√	√	√
MacBook Air (13-inch, 2017)	MacBook Air 2020 Learning Track				√	√
MacBook Air (Retina, 2018)						√
MacBook Air (Retina, 2019)						

MacBook 12-inch models	ACMT	ACMT 2015	ACMT 2016	ACMT 2017	ACMT 2018	ACMT 2019
MacBook (Retina, 12-inch, Early 2015)		√	√	√	√	√
MacBook (Retina, 12-inch, Early 2016)	MacBook Learning Track			√	√	√
MacBook (Retina, 12-inch, 2017)				√	√	√

iMac (all models)	ACMT	ACMT 2015	ACMT 2016	ACMT 2017	ACMT 2018	ACMT 2019
iMac (27-inch, Late 2013)	√	√	√	√	√	√
iMac (21.5-inch, Late 2013)	√	√	√	√	√	√
iMac (21.5-inch, Mid 2014)		√	√	√	√	√
iMac (21.5-inch, Late 2015)		√	√	√	√	√
iMac (21.5-inch, 2017)					√	√
iMac (Retina 4K, 21.5-inch, Late 2015)				√	√	√
iMac (Retina 4K, 21.5-inch, 2017)					√	√
iMac (Retina 4K, 21.5-inch, 2019)	iMac Learning Track					
iMac (Retina 5K, 27-inch, Late 2014)			√	√	√	√
iMac (Retina 5K, 27-inch, Mid 2015)			√	√	√	√
iMac (Retina 5K, 27-inch, Late 2015)			√	√	√	√
iMac (Retina 5K, 27-inch, 2017)					√	√
iMac (Retina 5K, 27-inch, 2019)						

iMac Pro (all models)	ACMT	ACMT 2015	ACMT 2016	ACMT 2017	ACMT 2018	ACMT 2019
iMac Pro (2017)	iMac Pro Learning Track				√	√
Mac Pro (Late 2013)	√	√	√	√	√	√

Mac mini (all models)	ACMT	ACMT 2015	ACMT 2016	ACMT 2017	ACMT 2018	ACMT 2019
Mac mini (Late 2014)	√	√	√	√	√	√
Mac mini (2018)	Mac mini Learning Track				√	

Mac Pro (all models)	ACMT	ACMT 2015	ACMT 2016	ACMT 2017	ACMT 2018	ACMT 2019
Mac Pro (2019)	<i>Mac Pro (2019) Learning Track</i>					
Mac Pro (Rack, 2019)	<i>Mac Pro (Rack, 2019) Learning Track</i>					

Connector Types on Logic Board

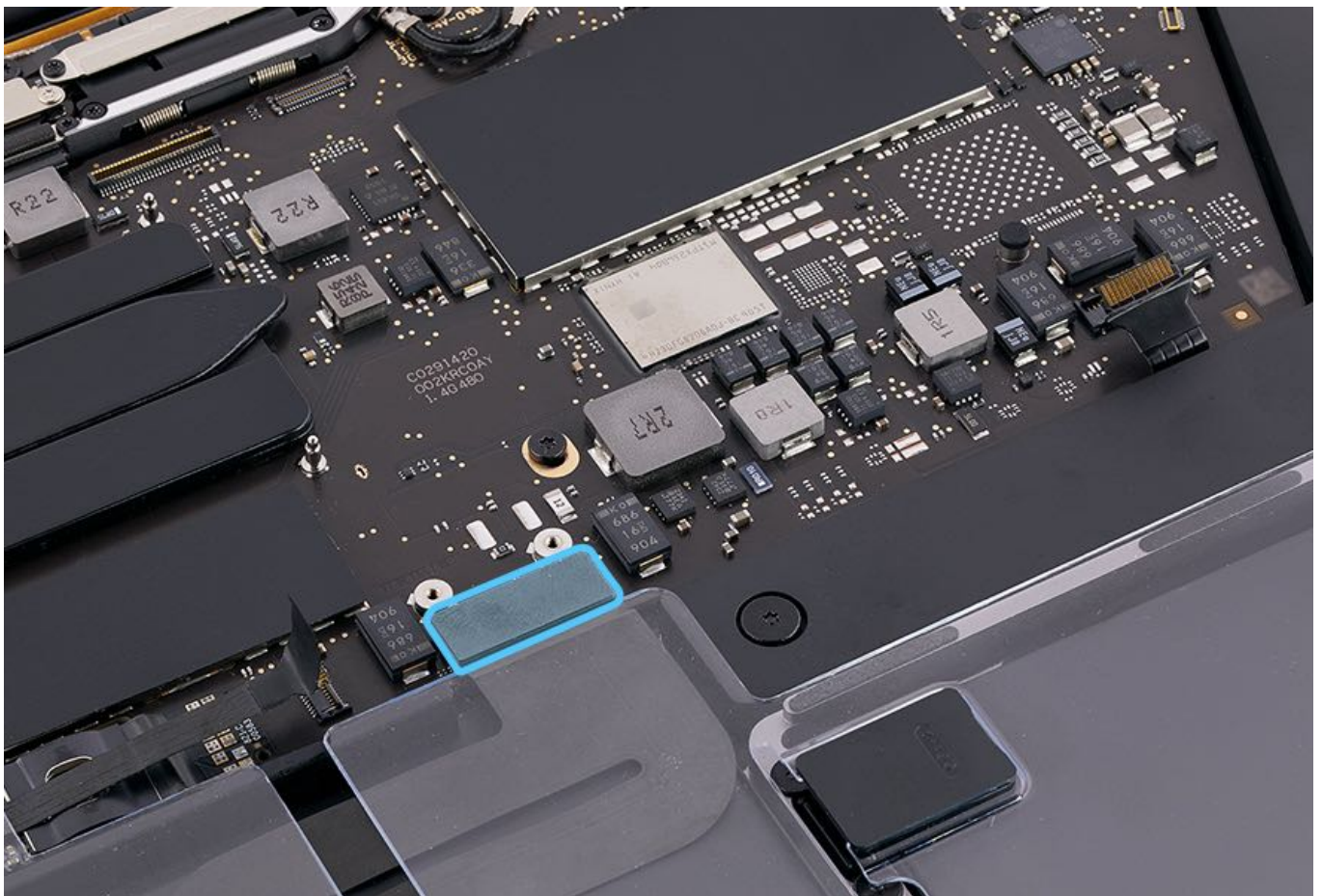
Connector Types on Logic Board for MacBook Pro (13-inch, 2019 and 2020, Two Thunderbolt 3 Ports)

Low-Profile Solid Platform

- Disconnect the flex cable from the solid platform connector in one vertical motion. This type of connector is susceptible to bent pins if the flex cable is rocked from side to side or inserted improperly.
- Reconnect the flex cable to the solid platform connector by first aligning the flex cable over the solid platform connector receptacle. Press down evenly on the top of the flex cable connector to insert it into the connector receptacle.

Examples:

- Audio board flex assembly
- Trackpad
- Embedded DisplayPort (eDP)
- I/O Board
- Touch Bar touch and Touch Bar display



Locking Lever

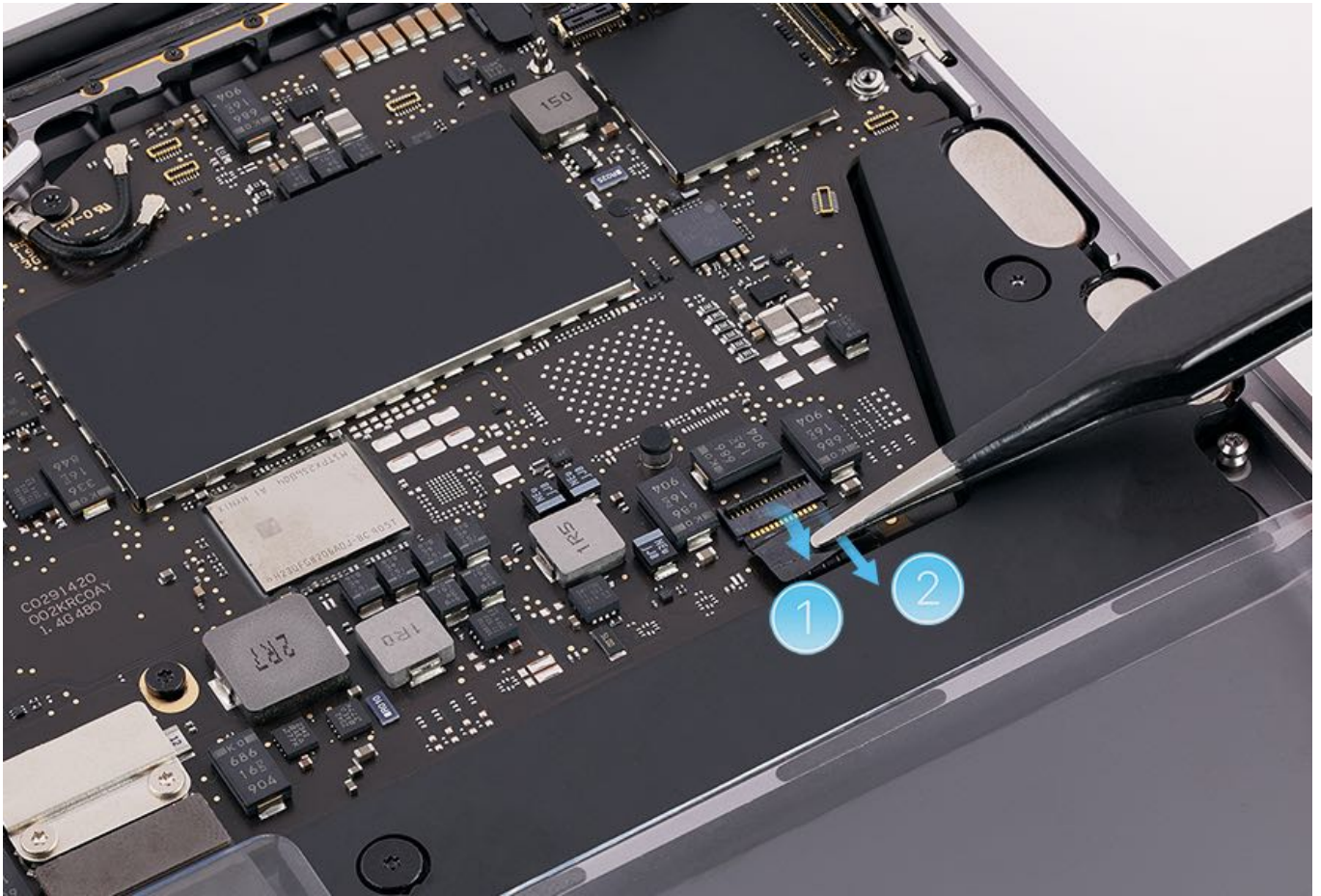
- Flip up lever 90 degrees and evenly disconnect cable.
- Lock down lever after inserting cable.
- Close lever when handling or shipping a logic board module, whether a known-good or a known-bad board.
- Watch the [Locking Lever Flex Connectors](#) .

Examples:

- Speaker
- Keyboard
- Fan
- Battery Management Unit (BMU) Signal



Caution: The locking levers on the logic board are fragile. To protect the levers during handling or shipment of the logic board, close the levers after the cables are disconnected. Once the logic board is installed in the top case and the cables are connected, be sure to lock down the levers again.

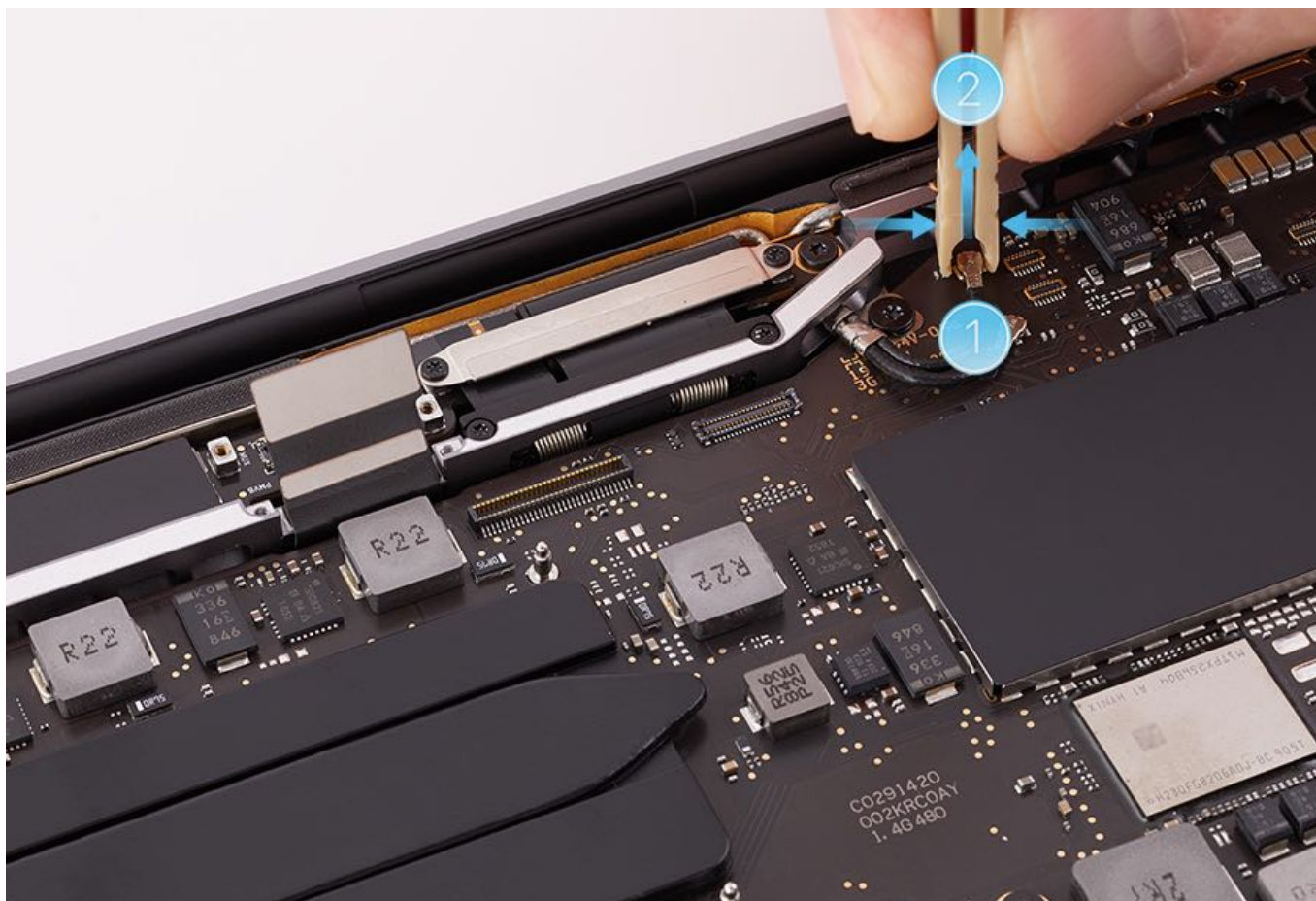


Wireless Antenna Cables

- With the antenna tool, grasp the head of the cable (1) and gently lift up (2).
- To reconnect line up the coaxial cable over the connector and use the flat side of the antenna tool to connect.

Examples:

- Wi-Fi and Bluetooth antenna



MacBook Pro (13-inch, 2019 and 2020, Two Thunderbolt 3 Ports) Tools and Fixtures

Tools and Fixtures for MacBook Pro (13-inch, 2019 and 2020, Two Thunderbolt 3 Ports)

The following tools are required:

ESD-Safe Workstation

- Grounded ESD Mat
- ESD wrist or heel strap with clip/plug
- ESD storage bags (for storing ESD-sensitive parts while removed from the unit)

General Tools

- Antenna tool (923-01322)
- Battery cover (923-01318)
- Black stick
 - 922-5065 (4-pack)
 - 922-9004 (24-pack)
 - 922-9005 (96-pack)
- Bottom case removal/install fixture kit (076-00290), which includes:
 - Bottom case fixture
 - Quick grip clamps (2), also available separately (923-01369)
 - Nonslip gloves, small (pair), also available separately (923-01371)
 - Nonslip gloves, extra large (pair), also available separately (923-01370)
- Clean, soft, lint-free cloth (922-8263)
- ESD-safe tweezers
- Kapton tape (922-1731)
- Keycap lever (923-01803)
- Keycap tool kit (076-00457) which includes:
 - Keycap lever
 - Precut VHB adhesive strips.
- Suction cup (922-8252)
- Thermal grease syringe (922-7144)
- Touch ID alignment tools
 - 923-01586 (2019 model only, includes edge guide)
 - 923-03032 (2020 model only)
- Trackpad gap offset tools (923-02998)
- Trackpad calibration weights, 200 g and 800 g (923-00462)
- Weight Placement Rubber Template
 - 923-01316 (2019 model only)
 - 923-04161 (2020 model only)
- Pentalobe screwdriver (923-0731)
- Torx T3 screwdriver
- Torx T5 screwdriver
- Torx T8 screwdriver
- 3 mm hex nut driver
- 10–34 Ncm torque driver (923-02995)
 - T5 security bit (923-02996) (for use with 10–34 Ncm torque driver)
- Torque driver (blue), 0.65 kg-fcm (923-0448)
 - 1IPR security bit (923-0247) (for use with the Torque driver (blue), 0.65 kg-fcm)

Miscellaneous Tools

- Compressed Air (optional)
- Isopropyl alcohol (IPA) wipe (included with heat sink)
- Magnifying glass (optional, for reading serial number)
- Nonslip gloves, medium/large (pair), (923-01368) (optional)
- Sticky notes

Take Apart Procedure Notes

Reassembly Steps

When no replacement steps are listed, replace parts in exact reverse order of Removal procedure.

Note About Images in This Guide

In some cases a pre-production model may have been used to document the procedures in this guide. Although there may be small differences in appearance between the image pictured and the computer you are servicing, the procedures are the same unless noted.

Screw Sizes

All screw sizes shown are approximate and represent the total length of the screw.



Bottom Case

First Steps



Warning:

- To avoid damaging parts, install the battery cover, disconnect the battery flex cable, and remove the BMU screw before you begin a repair.
- Don't connect the computer to an external power source during repair.

Important:

- Only [Apple-certified technicians](#) should perform this procedure.
- [Follow ESD guidelines](#) .
- [Follow battery safety precautions](#) before repairing the bottom case.

Perform the following steps before starting the repair:

- Shut down the computer.
- Unplug all cables.
- Put on an ESD wrist strap.
- Place the computer facedown on a clean, flat surface.



Tools

- ESD wrist strap
- Pentalobe screwdriver (923-0731)
- Battery cover:
 - 923-01318 for MacBook Pro (13-inch, 2016, 2017, 2019, 2020, Two Thunderbolt 3 Ports)
 - 923-01319 for MacBook Pro (13-inch, 2016 and 2017, Four Thunderbolt 3 Ports)
 - 923-02533 for MacBook Pro (13-inch, 2018, 2019, and 2020, Four Thunderbolt 3 Ports)

- 923-01320 for MacBook Pro (15-inch, 2016 and 2017)
- 923-02532 for MacBook Pro (15-inch, 2018 and 2019)
- 923-03891 for MacBook Pro (16-inch, 2019)
- Bottom case removal kit (076-00290)
- For MacBook Pro (16-inch, 2019): Bottom case extension kit (076-00459) (not shown)
- Fine-tip permanent marker
- Suction cup (922-8252)
- Clean, soft, lint-free cloth (not shown)



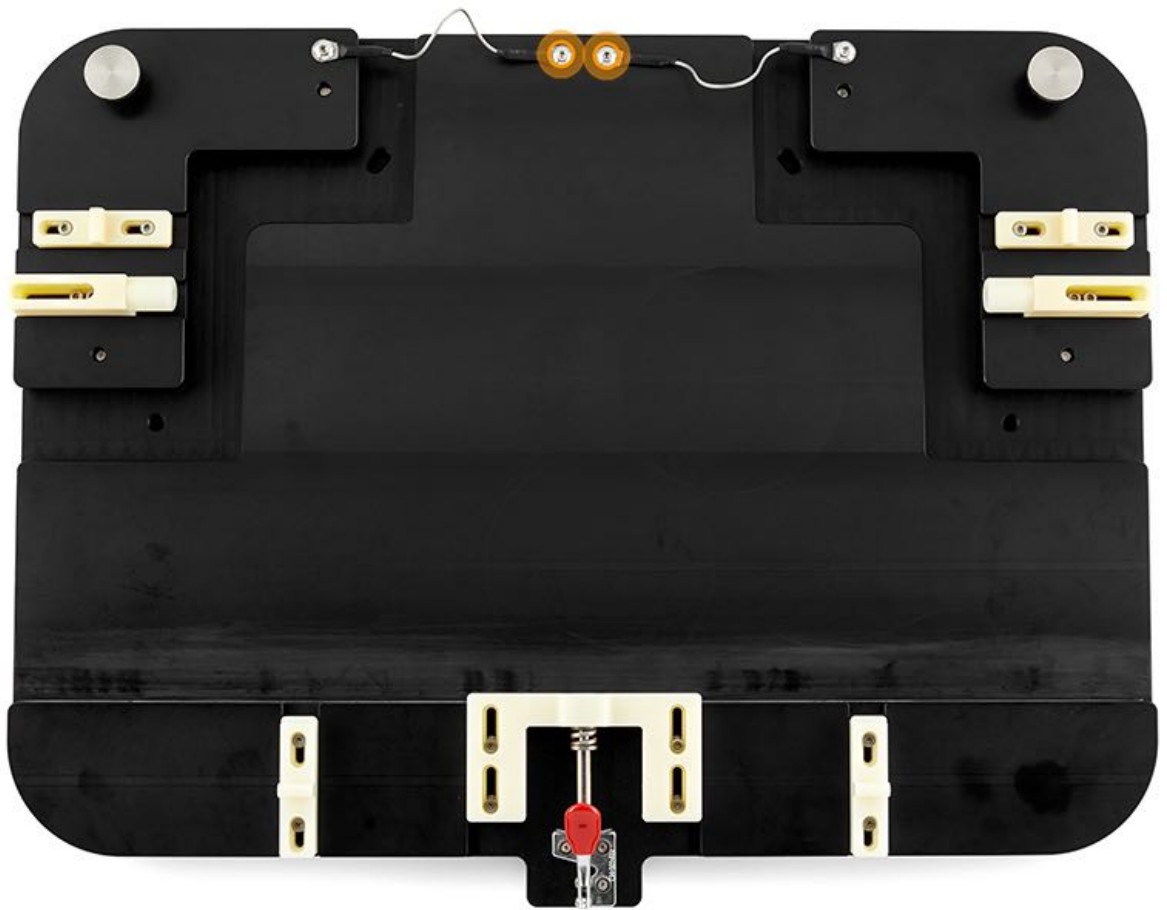
Steps For Removal

For MacBook Pro (16-inch, 2019):

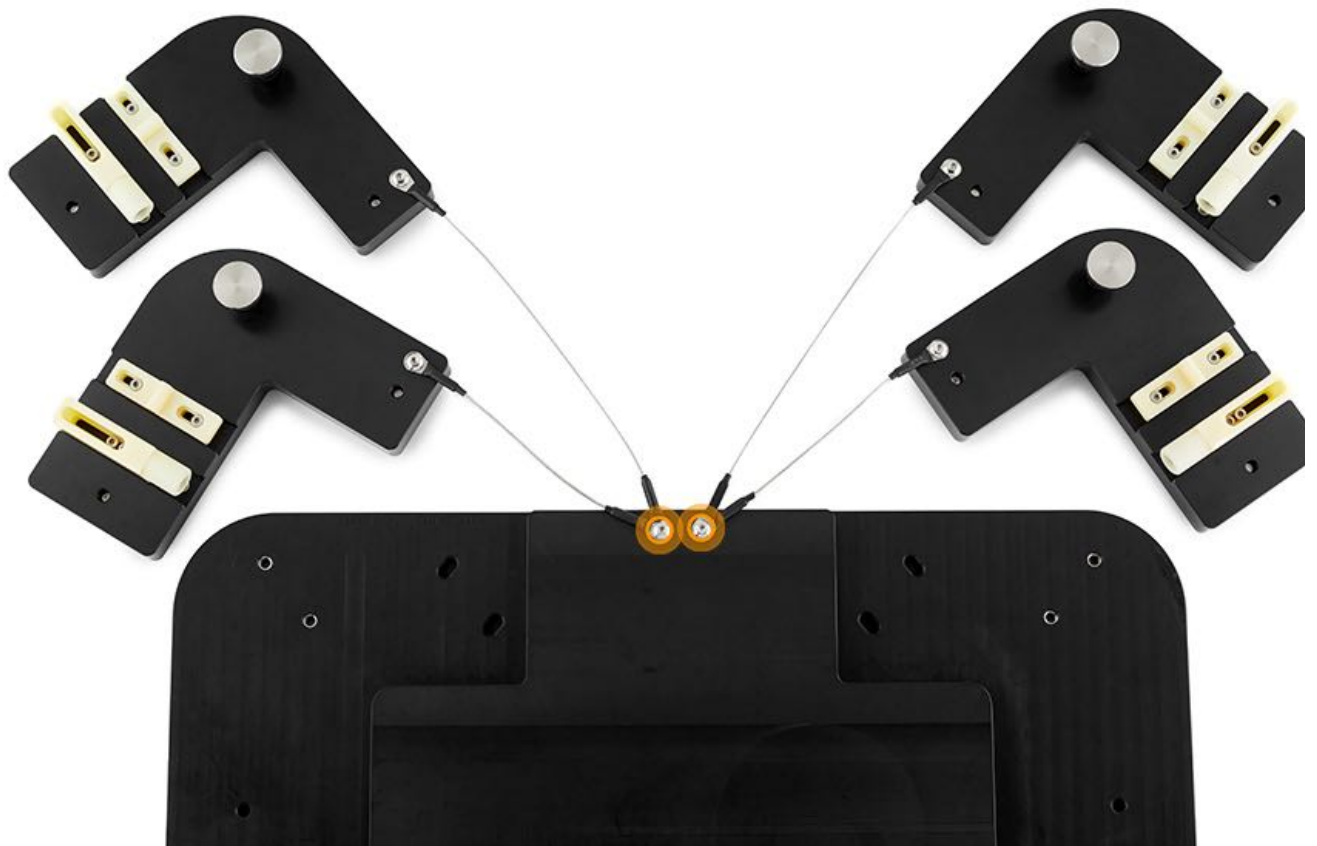
For MacBook Pro (16-inch, 2019) attach new corners to the bottom case removal kit. Find these corners in the bottom case removal extension kit (076-00459). You only need to install the new corners to the bottom case removal kit once.

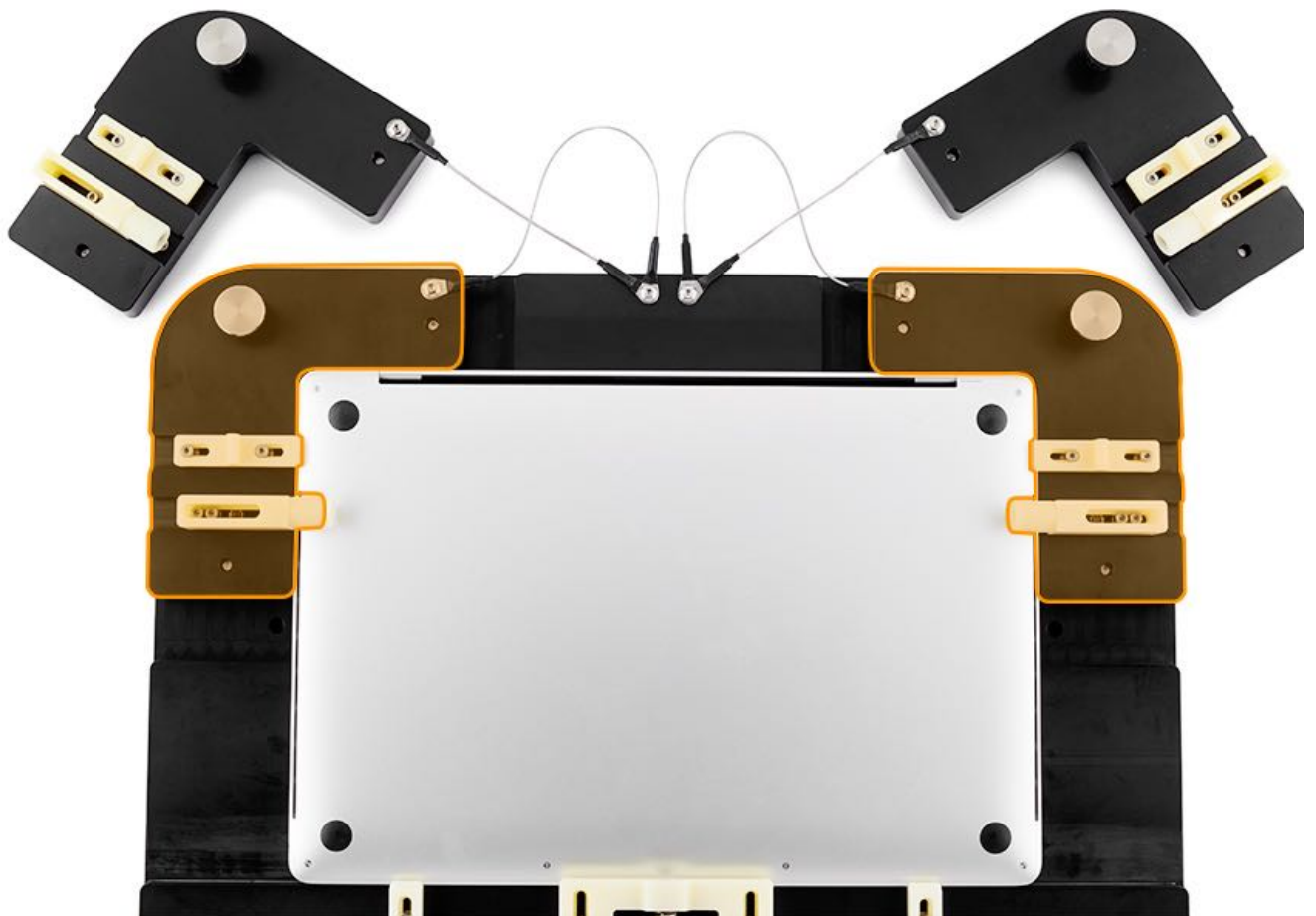
Note: There is a plus sign on the corners for the MacBook Pro (16-inch, 2019).

1. Use the hex driver from the kit to remove the two screws that attach the corner braces to the bottom case fixture.



2. Attach the new corner braces and reinstall the two screws. Use the new corner braces when repairing the MacBook Pro (16-inch, 2019).





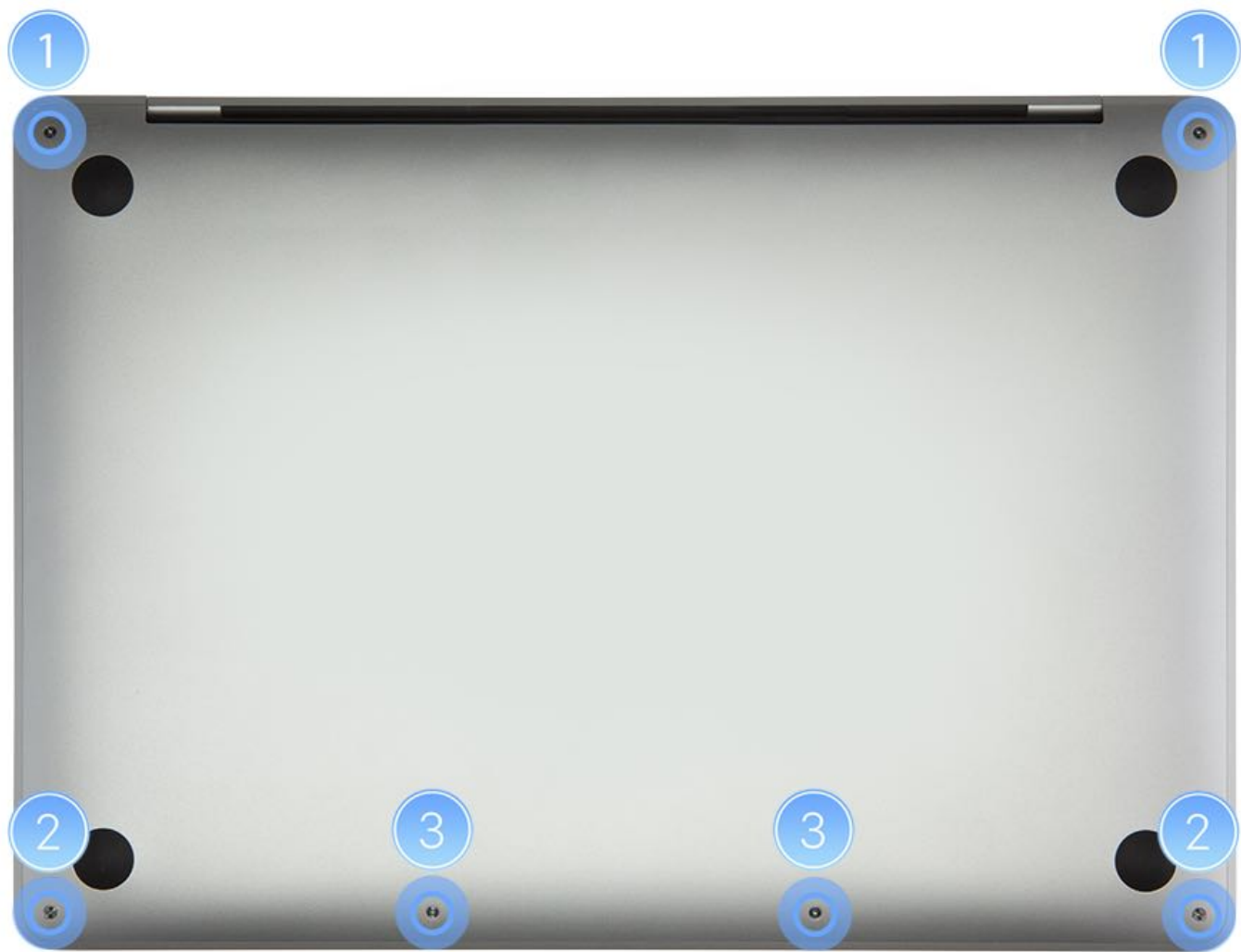
3. Remove the six Pentalobe screws from the bottom case.

MacBook Pro (16-inch, 2019)



MacBook Pro (16-inch, 2019)		
Color	Screw #1	Screw #2
Space Gray	923-03955 	923-03963 
Silver	923-03964 	923-03965 

MacBook Pro (13-inch, 2016, 2017, 2019, 2020, Two Thunderbolt 3 Ports)



MacBook Pro (13-inch, 2016 and 2017, Two Thunderbolt 3 Ports)

Color	Screw #1	Screw #2	Screw #3
Space Gray	923-01299 	923-01097 	923-01095 
Silver	923-01099 	923-01100 	923-01098 

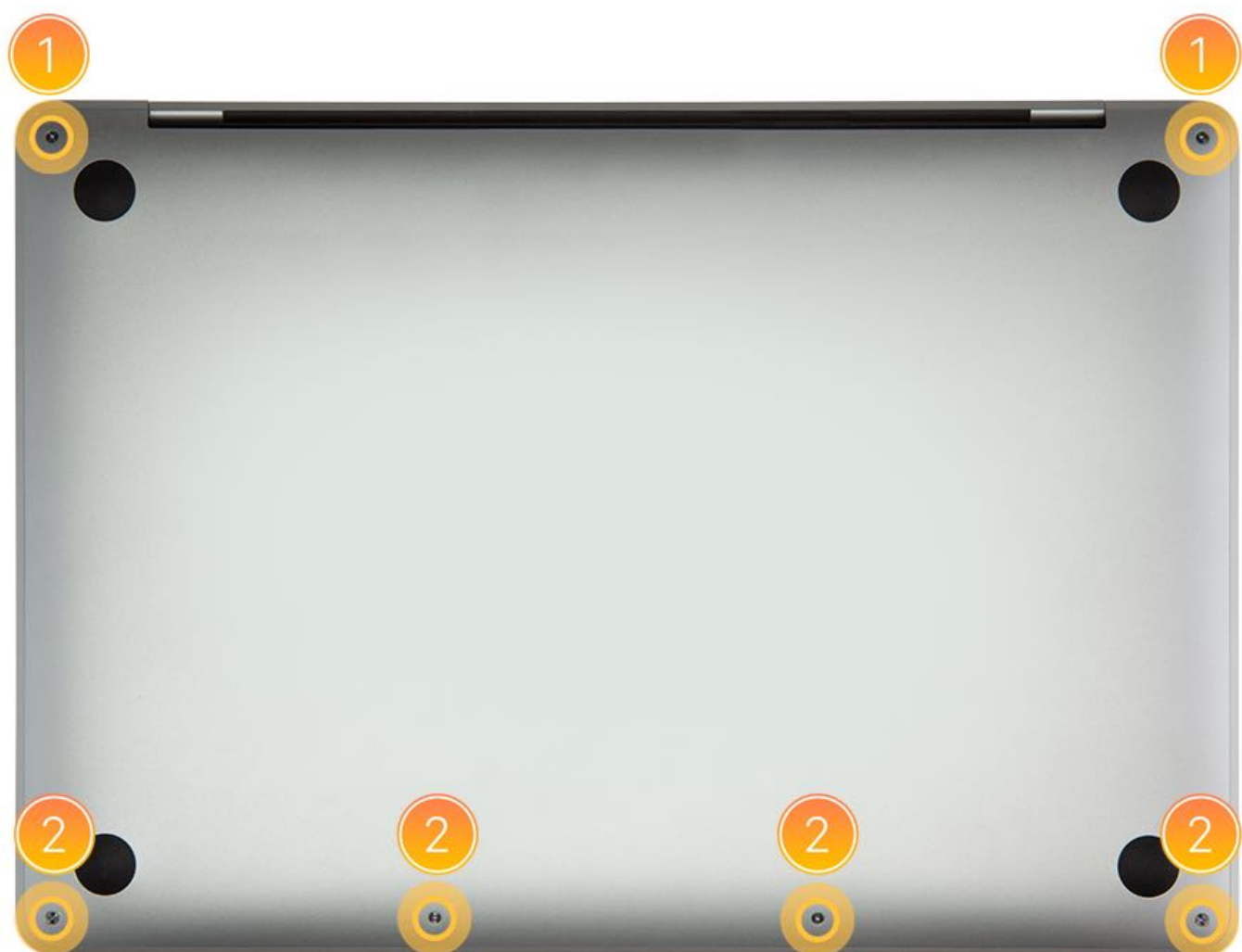
MacBook Pro (13-inch, 2019, Two Thunderbolt 3 Ports)

Color	Screw #1	Screw #2	Screw #3
Space Gray	923-03198 	923-03199 	923-03200 
Silver	923-03201 	923-03202 	923-03203 

MacBook Pro (13-inch, 2020, Two Thunderbolt 3 Ports)

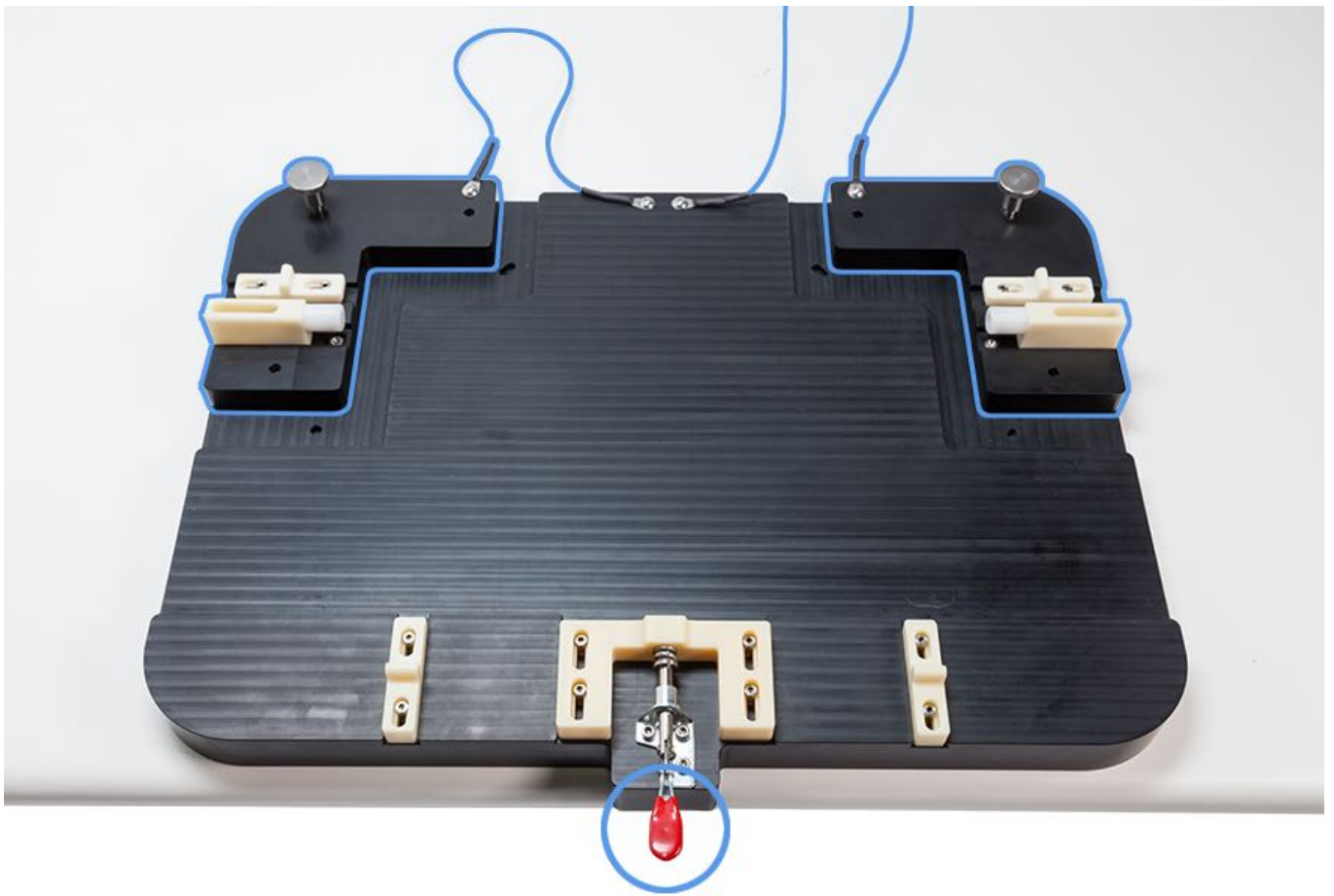
Color	Screw #1	Screw #2	Screw #3
Space Gray	923-04174 	923-04175 	923-04176 
Silver	923-04177 	923-04179 	923-04180 

MacBook Pro (13-inch, 2016, 2017, 2018, 2019, 2020, Four Thunderbolt 3 Ports) and MacBook Pro (15-inch, 2016, 2017, 2018, 2019)

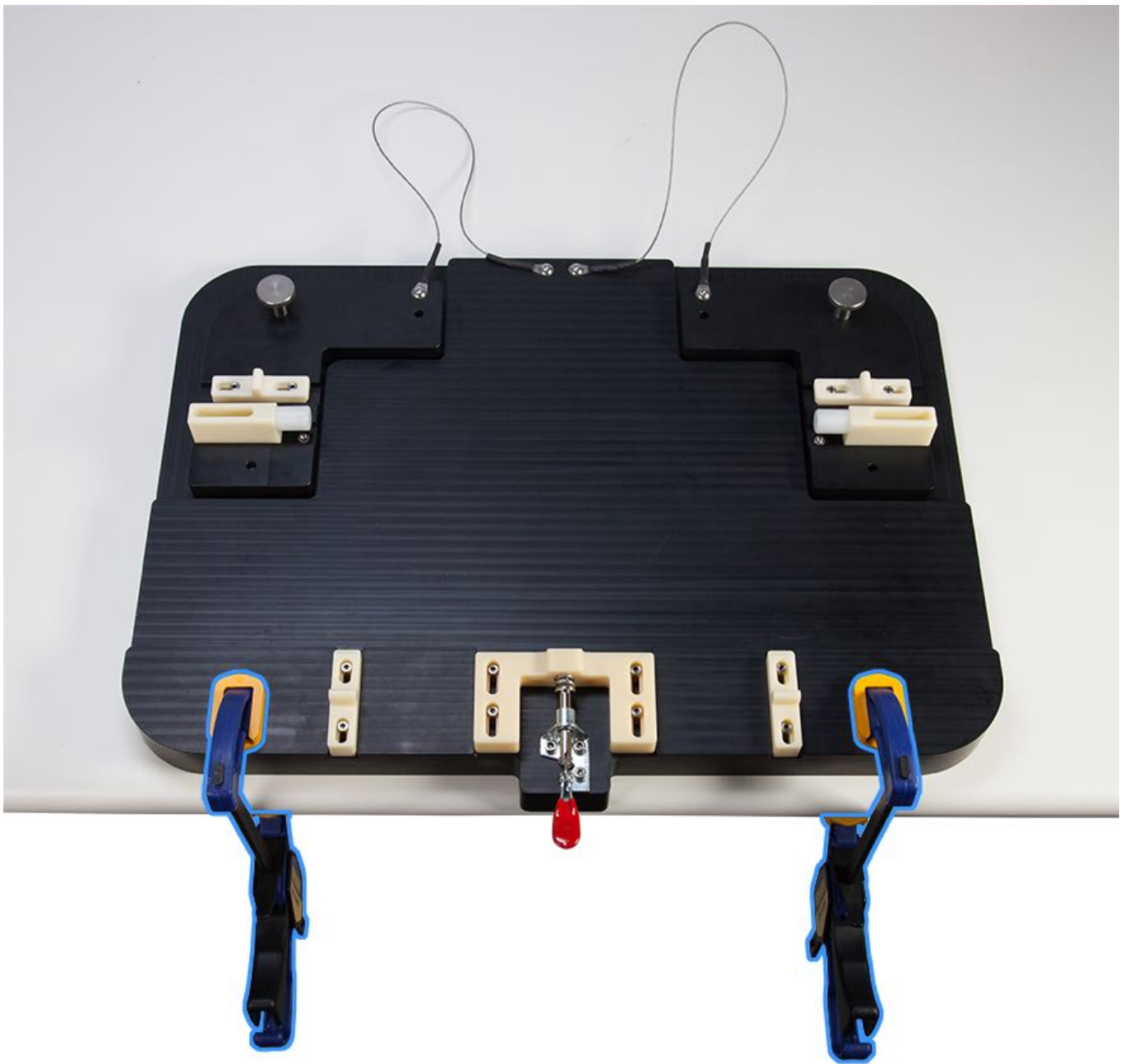


MacBook Pro (13-inch, 2016, 2017, 2018, 2019, Four Thunderbolt 3 Ports)		
Color	Screw #1	Screw #2
Space Gray	923-01096 	923-01413 
Silver	923-01415 	923-01431 
MacBook Pro (13-inch, 2020, Four Thunderbolt 3 Ports)		
Color	Screw #1	Screw #2
Space Gray	923-04174 	923-04176 
Silver	923-04177 	923-04180 
MacBook Pro (15-inch, 2016, 2017, 2018, 2019)		
Color	Screw #1	Screw #2
Space Gray	923-01514 	923-01513 
Silver	923-01517 	923-01516 

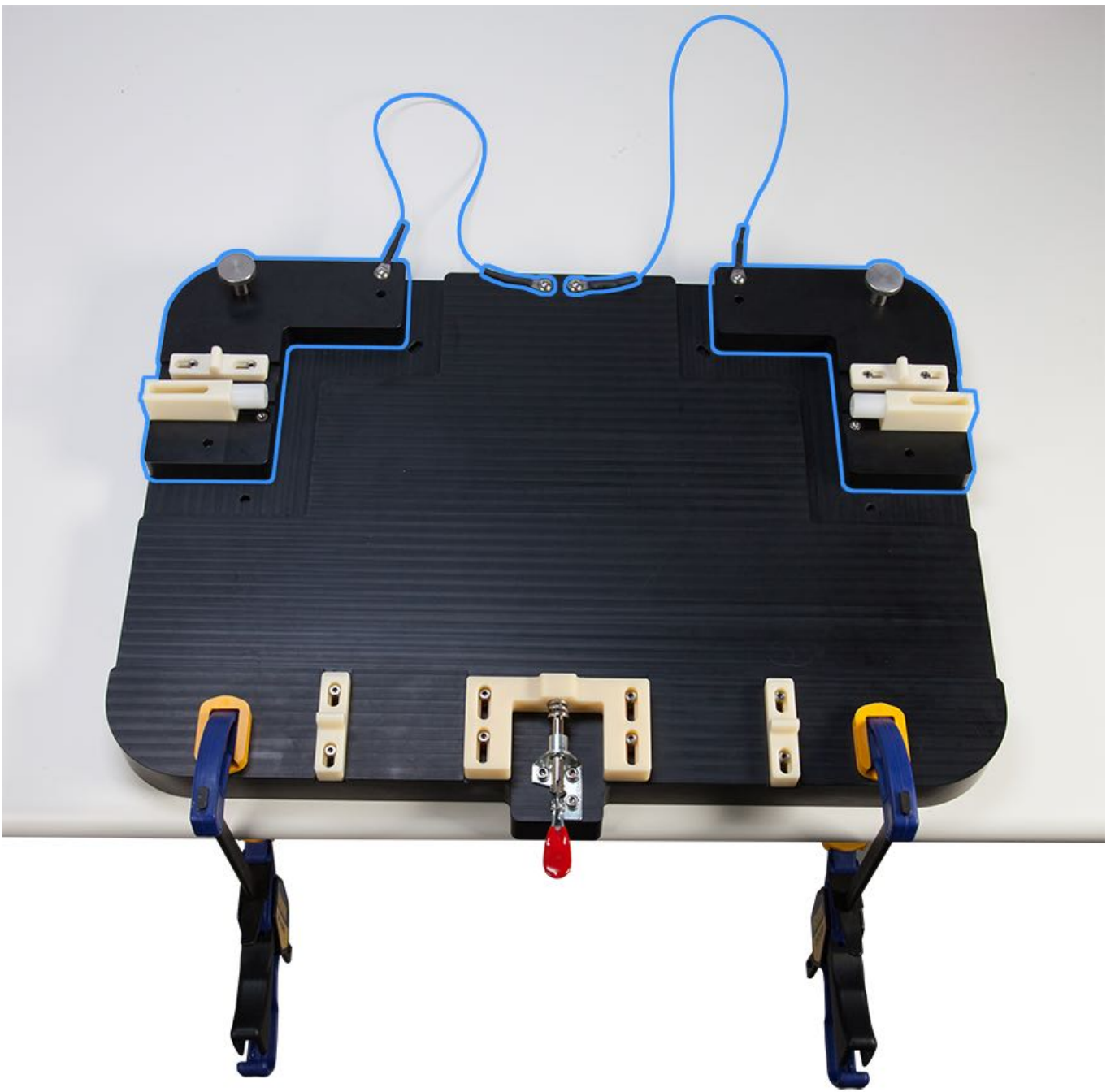
4. Position the bottom case fixture with the red lever at the bottom and the tethered corner braces at the top.



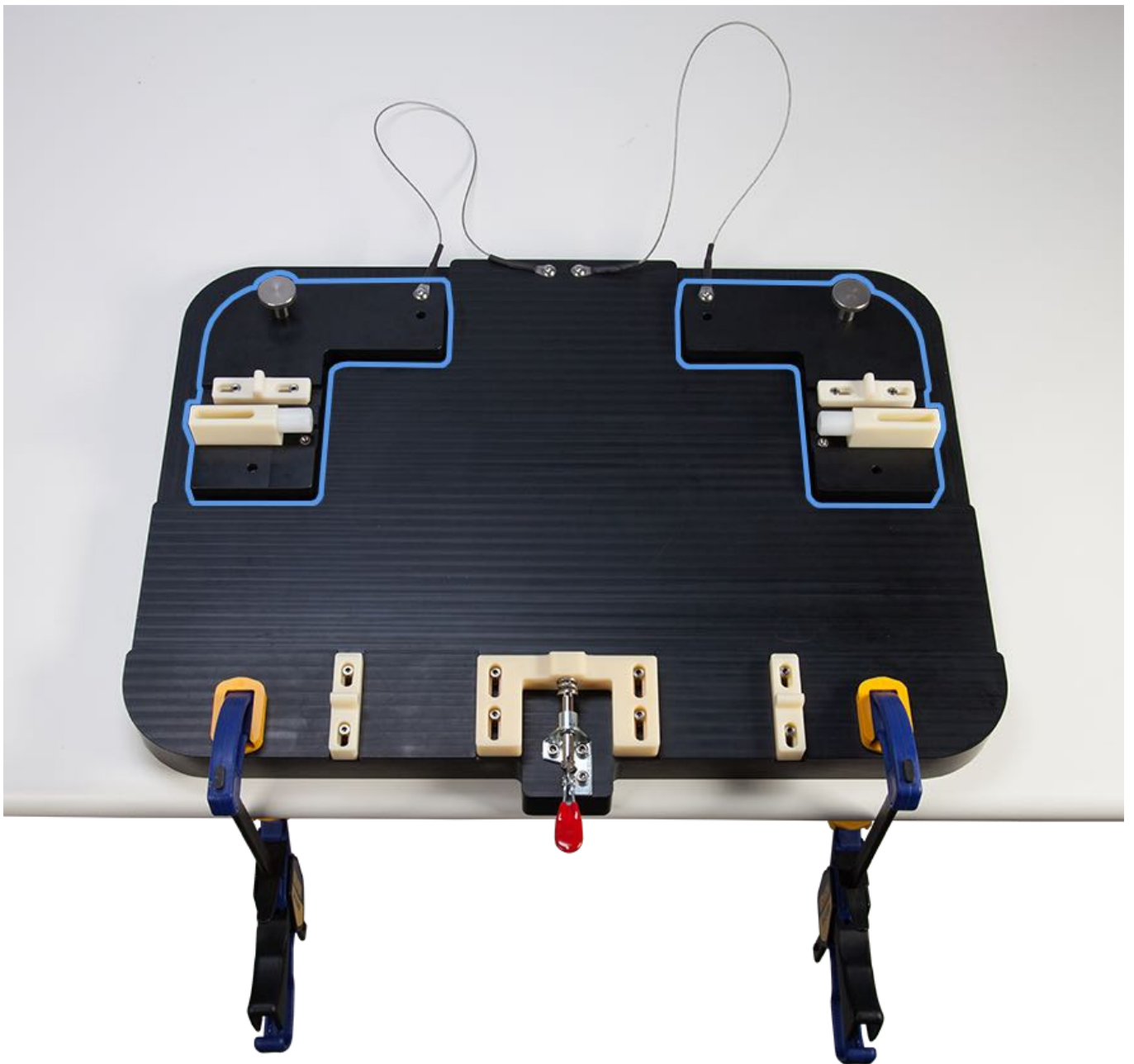
5. Use two clamps to secure the bottom case fixture to the table. Squeeze the clamp handles to tighten the clamps. Ensure that the sliding bars of the clamps are below the table.



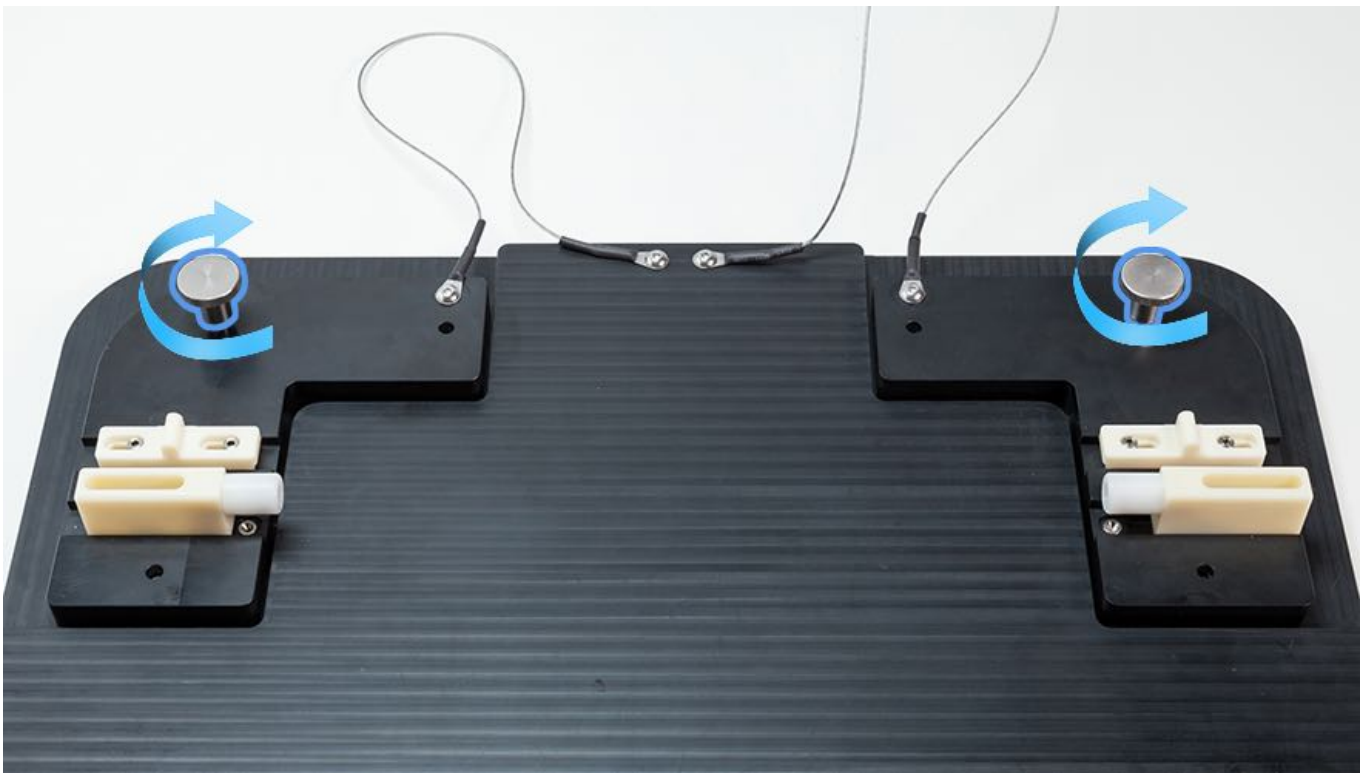
6. Position the corners to fit either a 13-inch, 15-inch, or 16-inch MacBook Pro. Move the braces outward for a 15-inch model as shown, or use the new corners included in the extension kit (076-00459) for a 16-inch model.



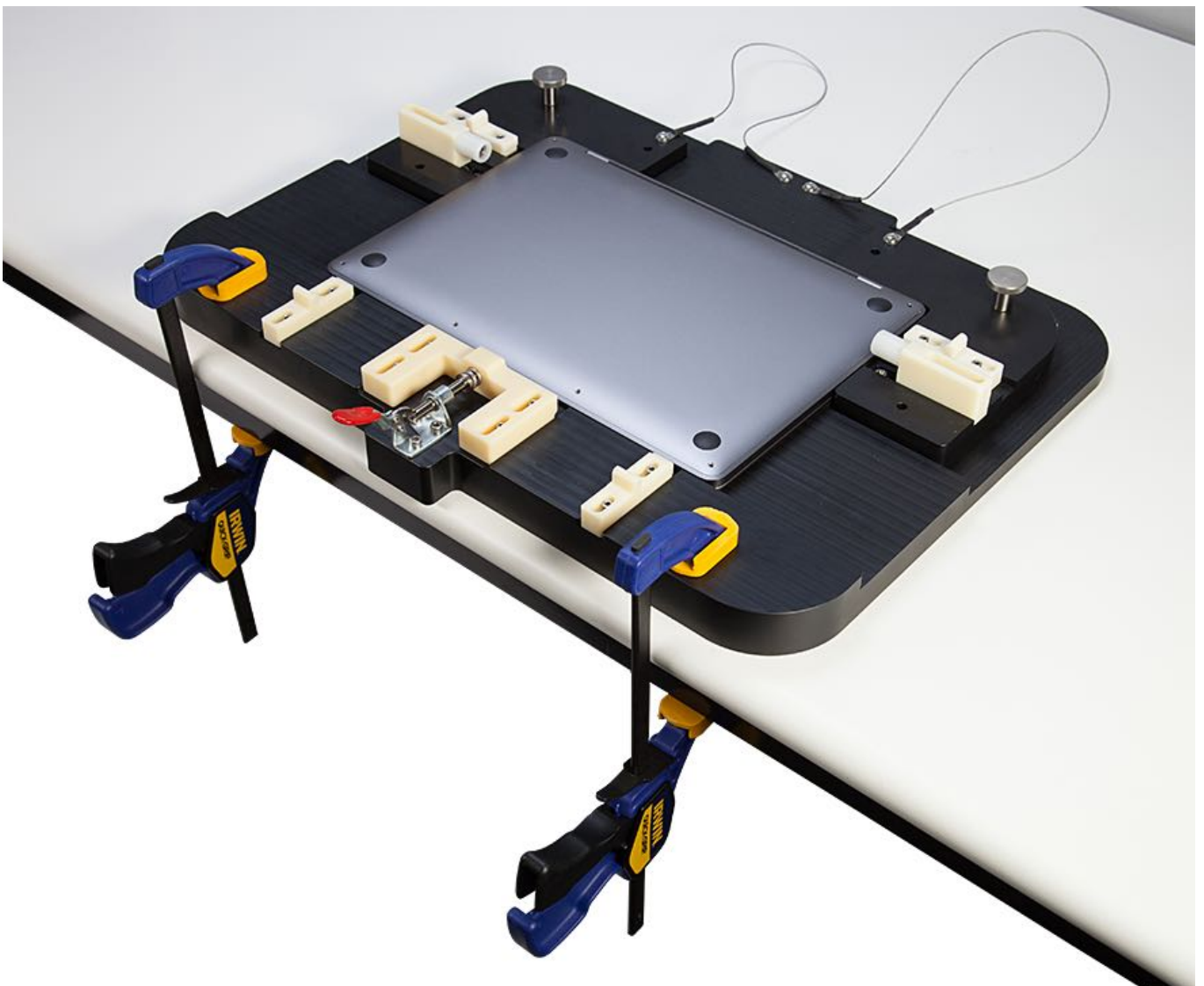
7. Move the braces inward for a 13-inch model, as shown.



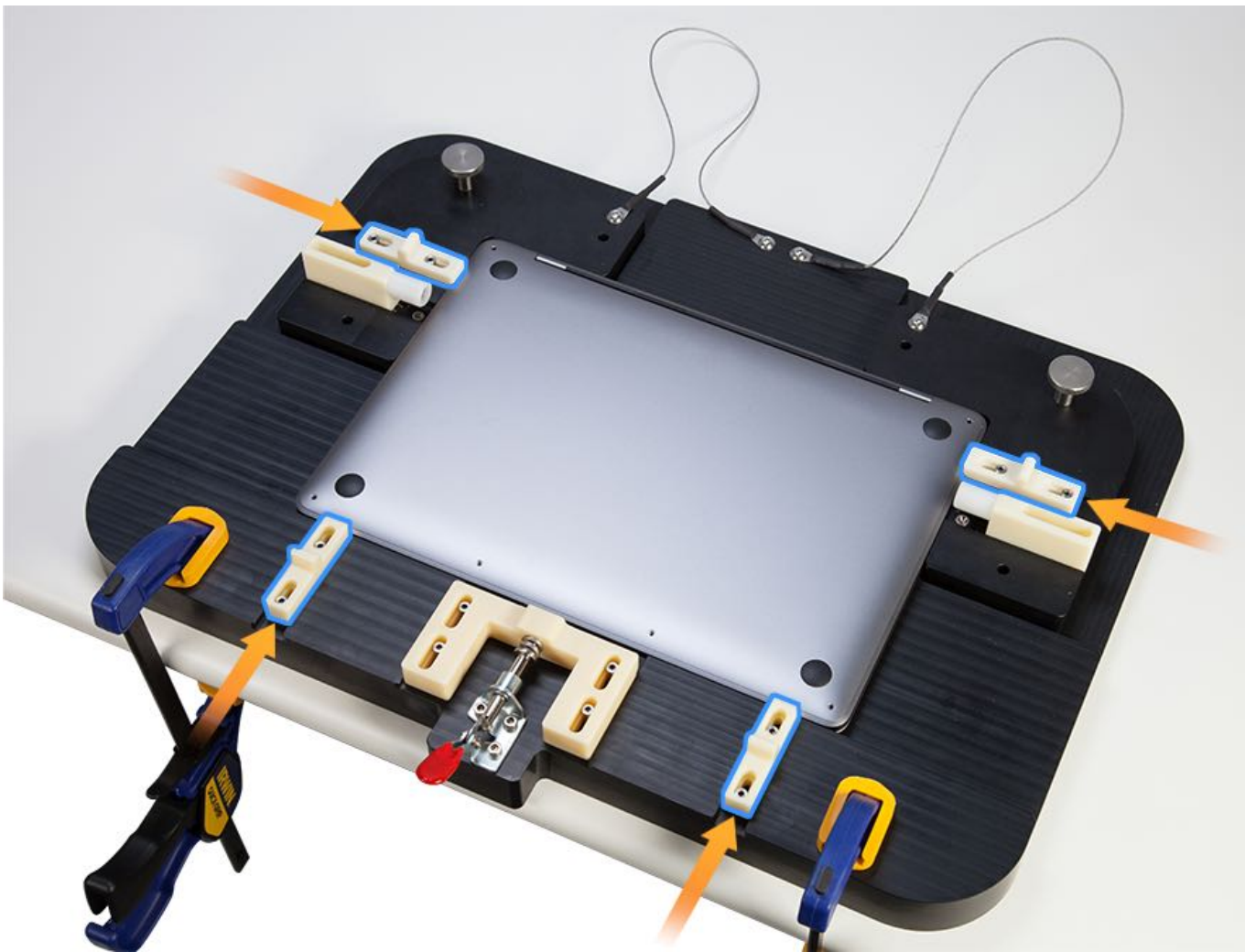
8. Tighten the silver thumbscrews.



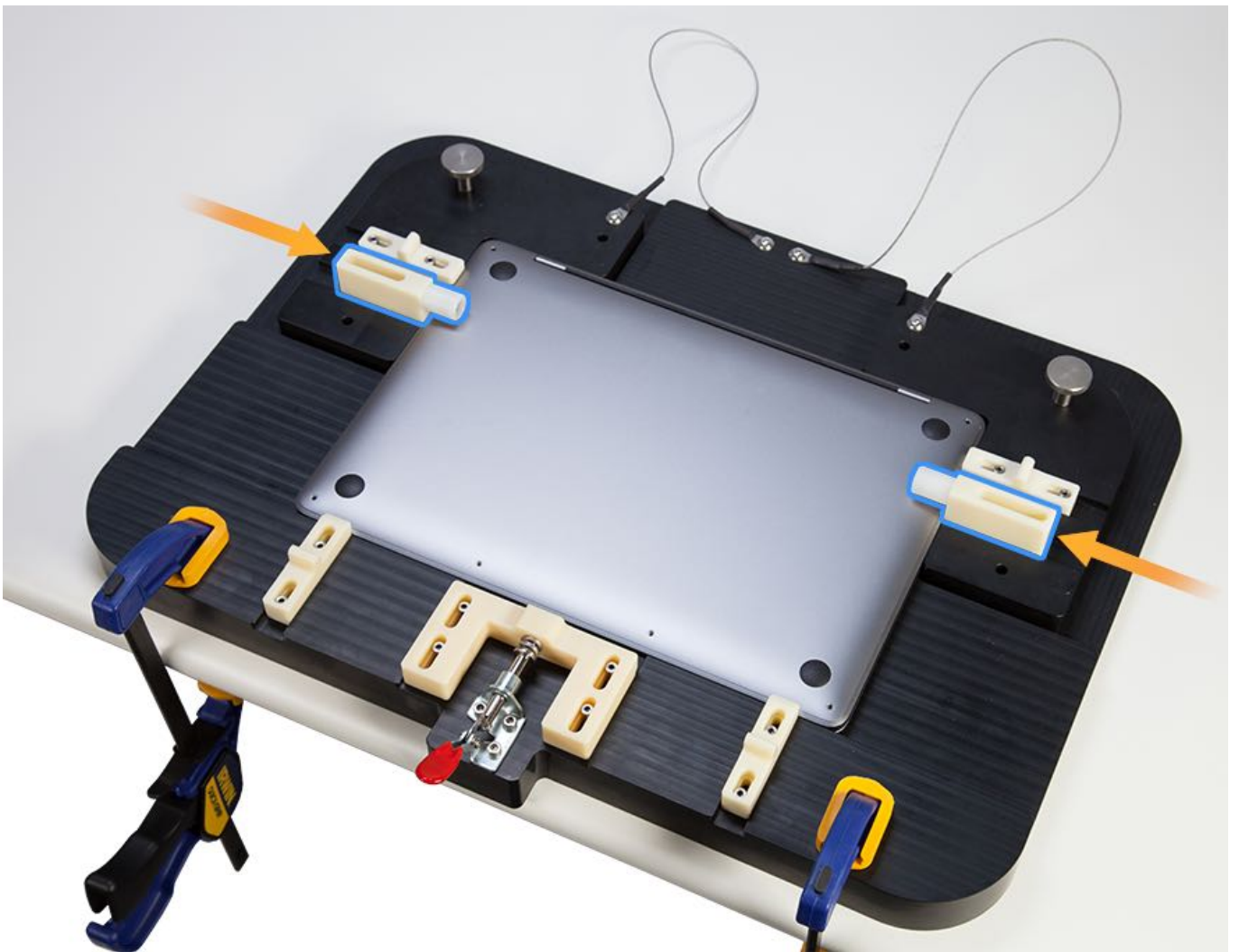
9. Place the computer facedown in the fixture with the display hinge at the top.



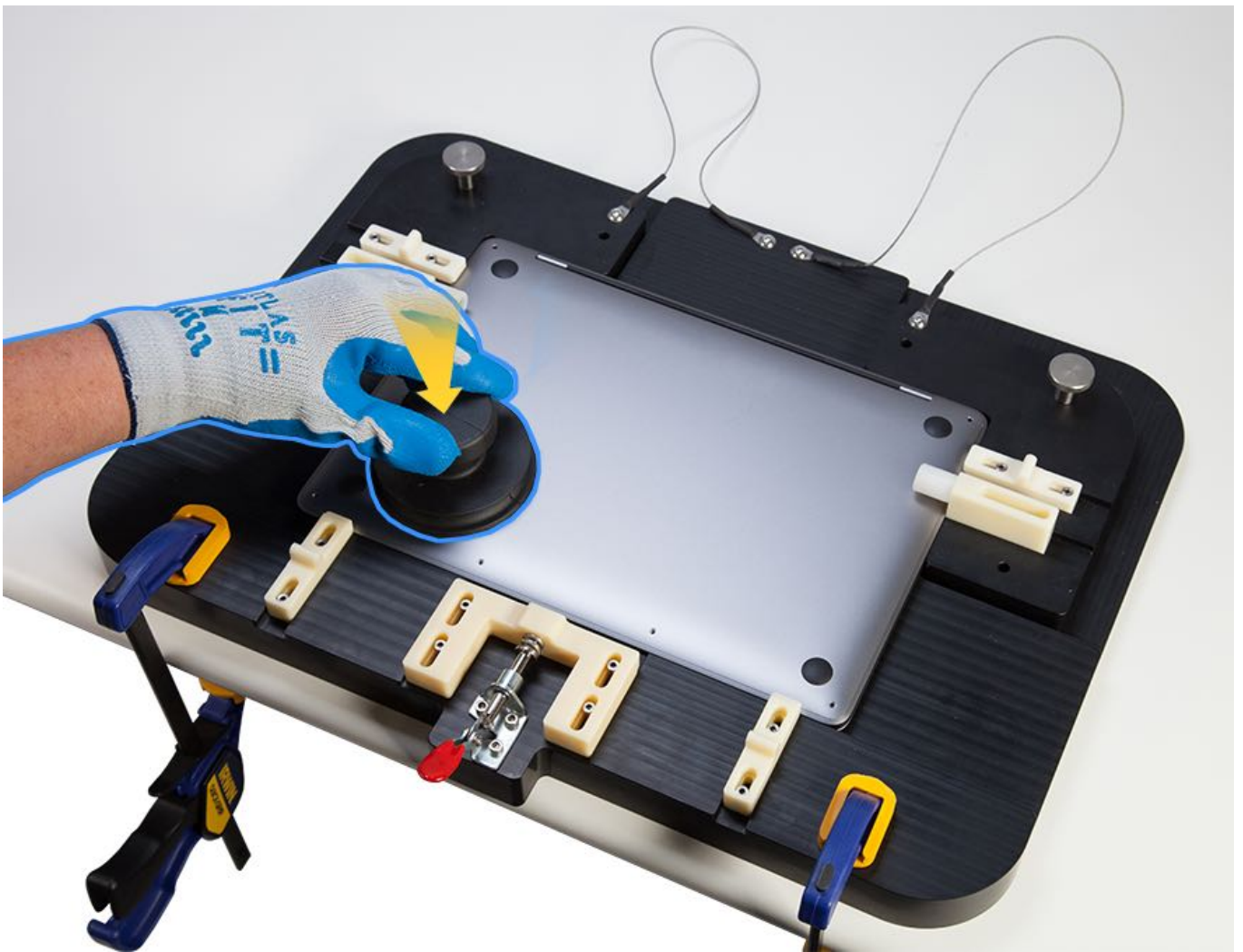
10. Push the four sliding locks inward to hold the computer in place. Ensure that the red lever is fully open.



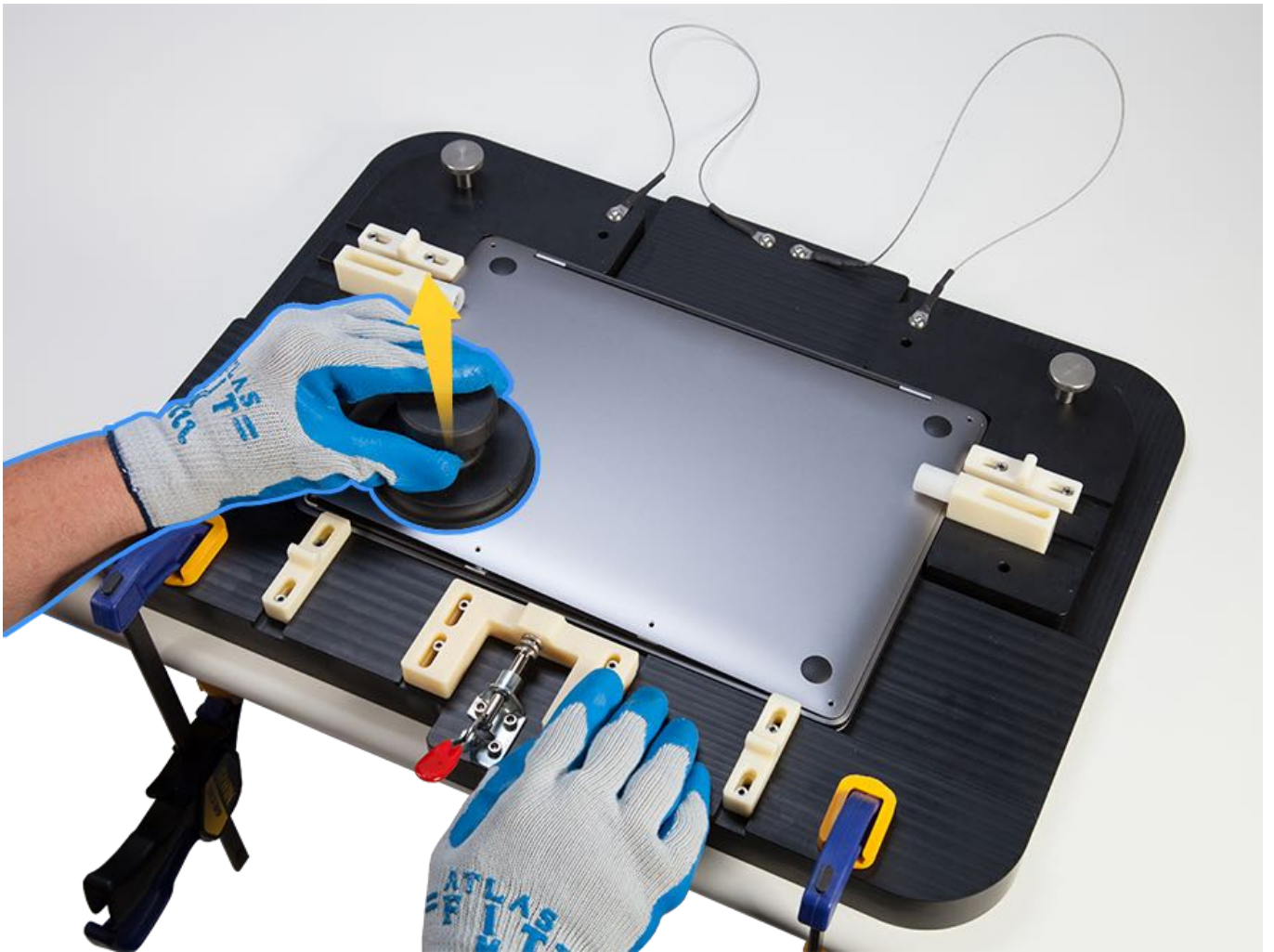
11. Press the two rollers inward to prevent the bottom case from tilting too far upward during removal.



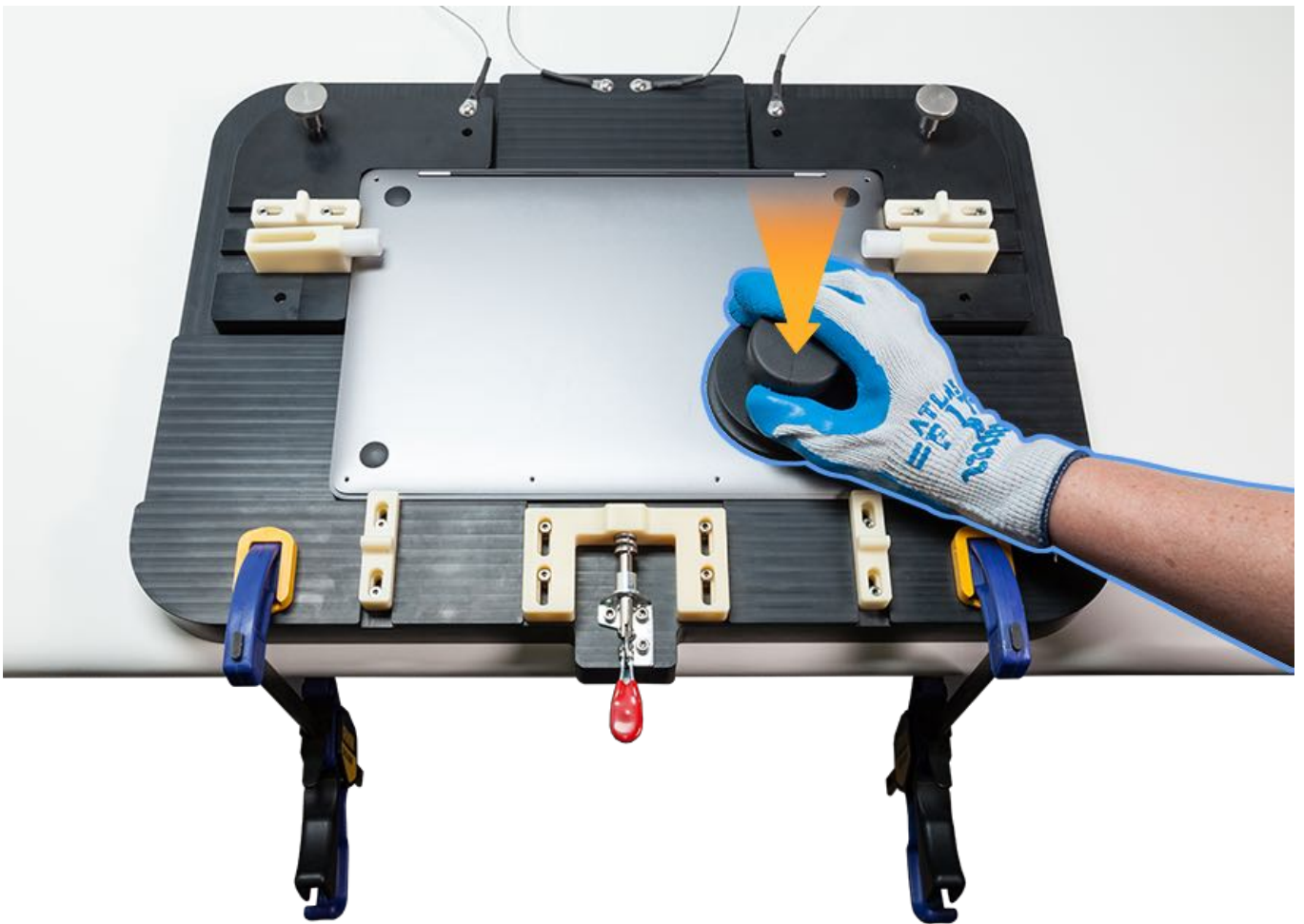
12. Put on the gloves. Then press the suction cup to attach it to the lower left corner of the bottom case.



13. Pull up on the suction cup just high enough (about 0.5 cm) to lift the bottom case and release two interior clips.
Caution: Don't insert a black stick into the opening or you could damage the battery.



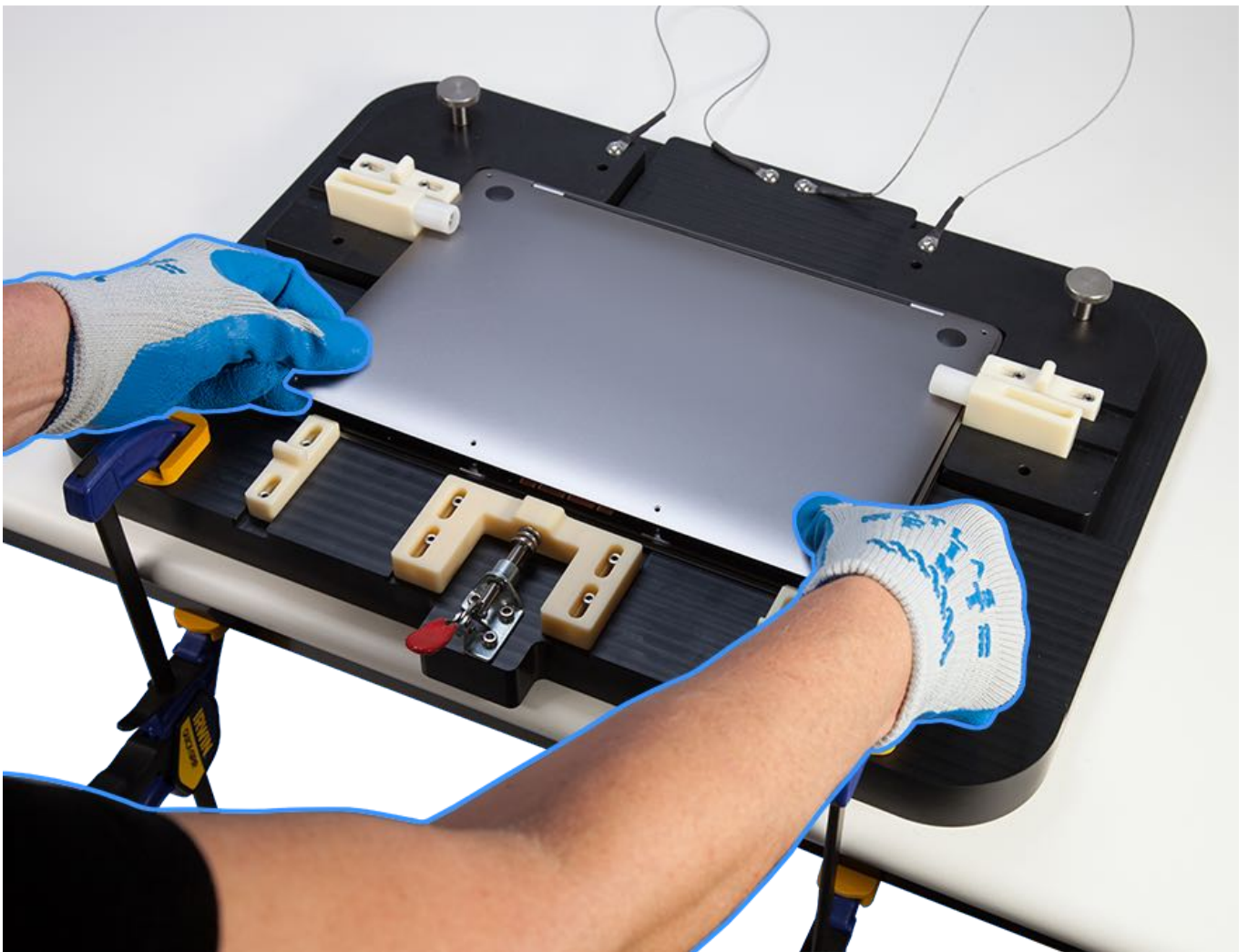
14. Peel the edges of the suction cup to release it. Move the suction cup to the lower right corner of the bottom case and press the top to attach it.



15. Pull up on the suction cup just high enough (about 0.5 cm) to release the remaining two interior clips.



16. Remove the suction cup. Then insert your index fingers into the narrow opening at the edges closest to you.



Caution: To protect the computer, keep the opening no more than a finger's width apart.



17. Position both hands in the recessed areas of the fixture to protect the internal parts when you remove the bottom case.



18. Apply gentle and steady pressure to slide the bottom case toward you by less than 0.5 inch to disengage the spring fingers.

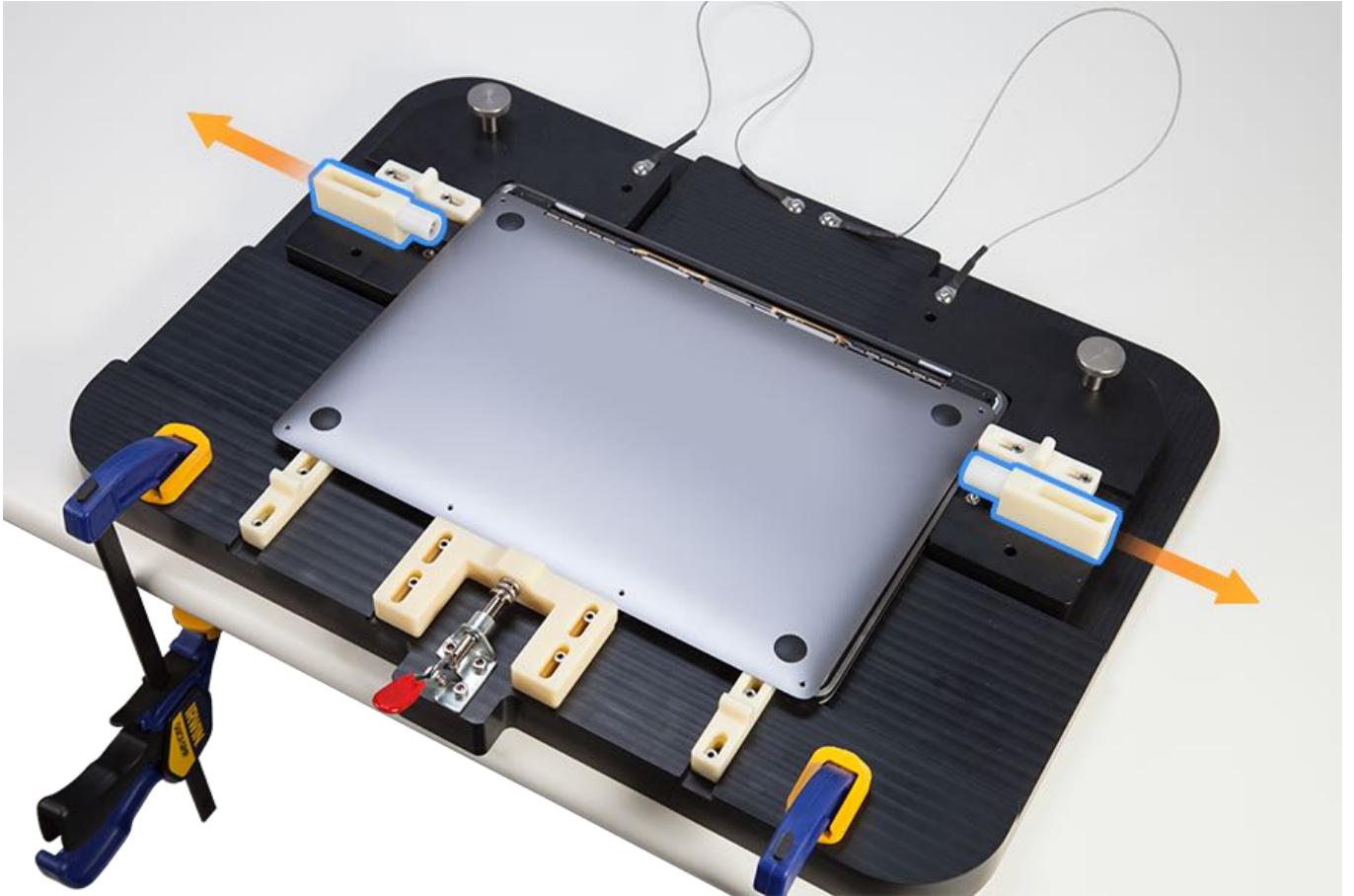
Caution: The spring fingers secure the bottom case and can release suddenly. Ensure that you don't drag the bottom case over internal parts when sliding it.



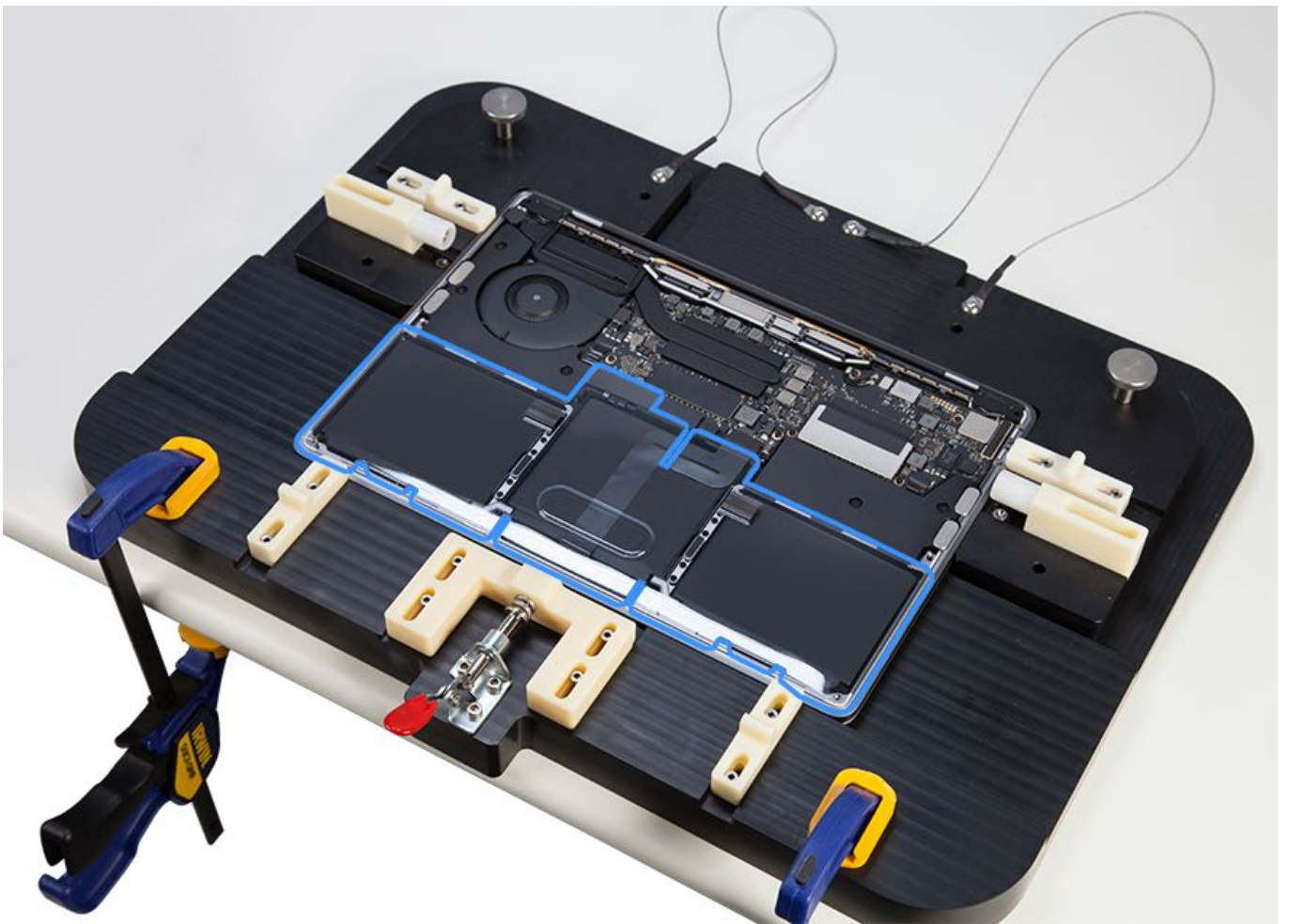
19. Rest the bottom case on the top case.



20. Remove the gloves, push the two rollers outward to disengage them, and remove the bottom case from the fixture.

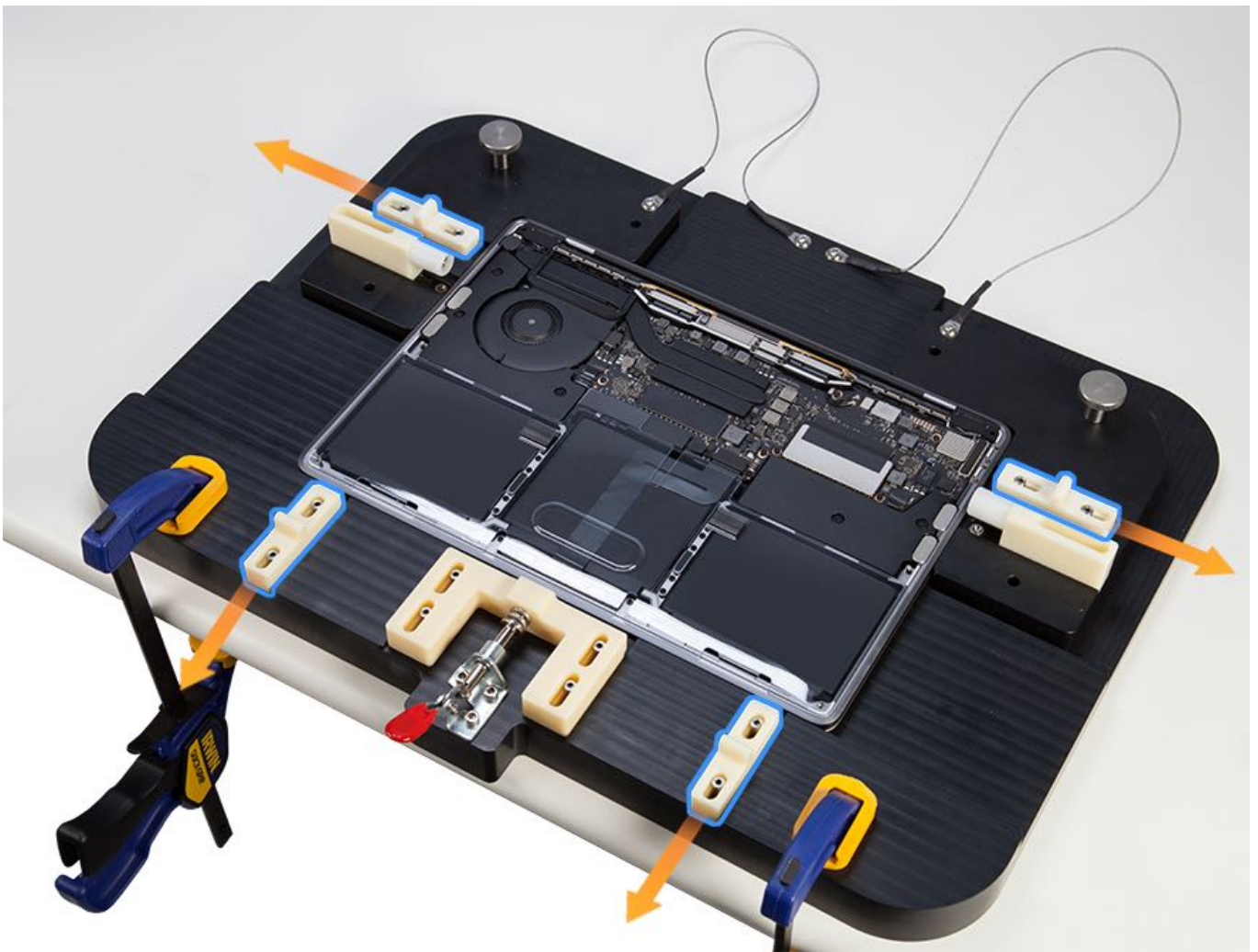


21. Place the protective battery cover on the battery. (The image below shows the 13-inch model.)



22. If you're replacing just the bottom case, go to the reassembly instructions. If you're performing an additional repair on the computer, don't perform that repair while the computer is in the bottom case fixture. Instead, perform the following steps:

- Release the four sliding locks, then lift the computer from the bottom case fixture.
- Transfer the computer to an ESD-safe surface.

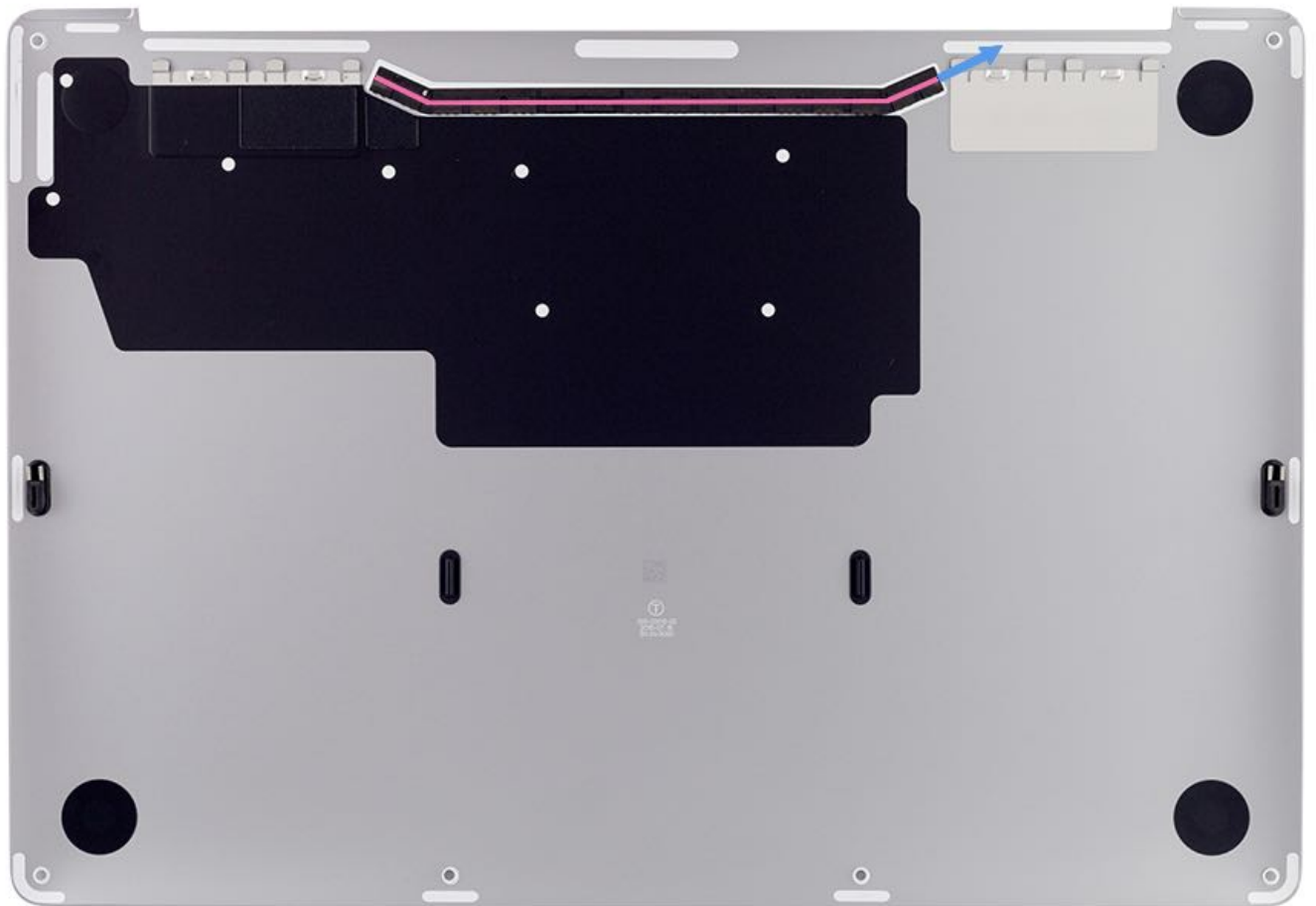


23. Disconnect the battery for the model you're repairing:

- [MacBook Pro \(13-inch, 2016 and 2017, Two Thunderbolt 3 Ports\)](#)
- [MacBook Pro \(13-inch, 2019, Two Thunderbolt 3 Ports\)](#)
- [MacBook Pro \(13-inch, 2020, Two Thunderbolt 3 Ports\)](#)
- [MacBook Pro \(13-inch, 2016, 2017, 2018, 2019, Four Thunderbolt 3 Ports\)](#)
- [MacBook Pro \(13-inch, 2020, Four Thunderbolt 3 Ports\)](#)
- [MacBook Pro \(15-inch, 2016, 2017, 2018, 2019\)](#)
- [MacBook Pro \(16-inch, 2019\)](#)

Steps For Reassembly

1. For MacBook Pro (15-inch, 2018 and 2019), [determine the correct part number](#) before ordering a replacement bottom case.
2. The replacement bottom case comes with a red tube that runs through the airloops. Grasp one end of the red tube and pull it out of the airloop gasket and discard it. The tube is only for shipment.

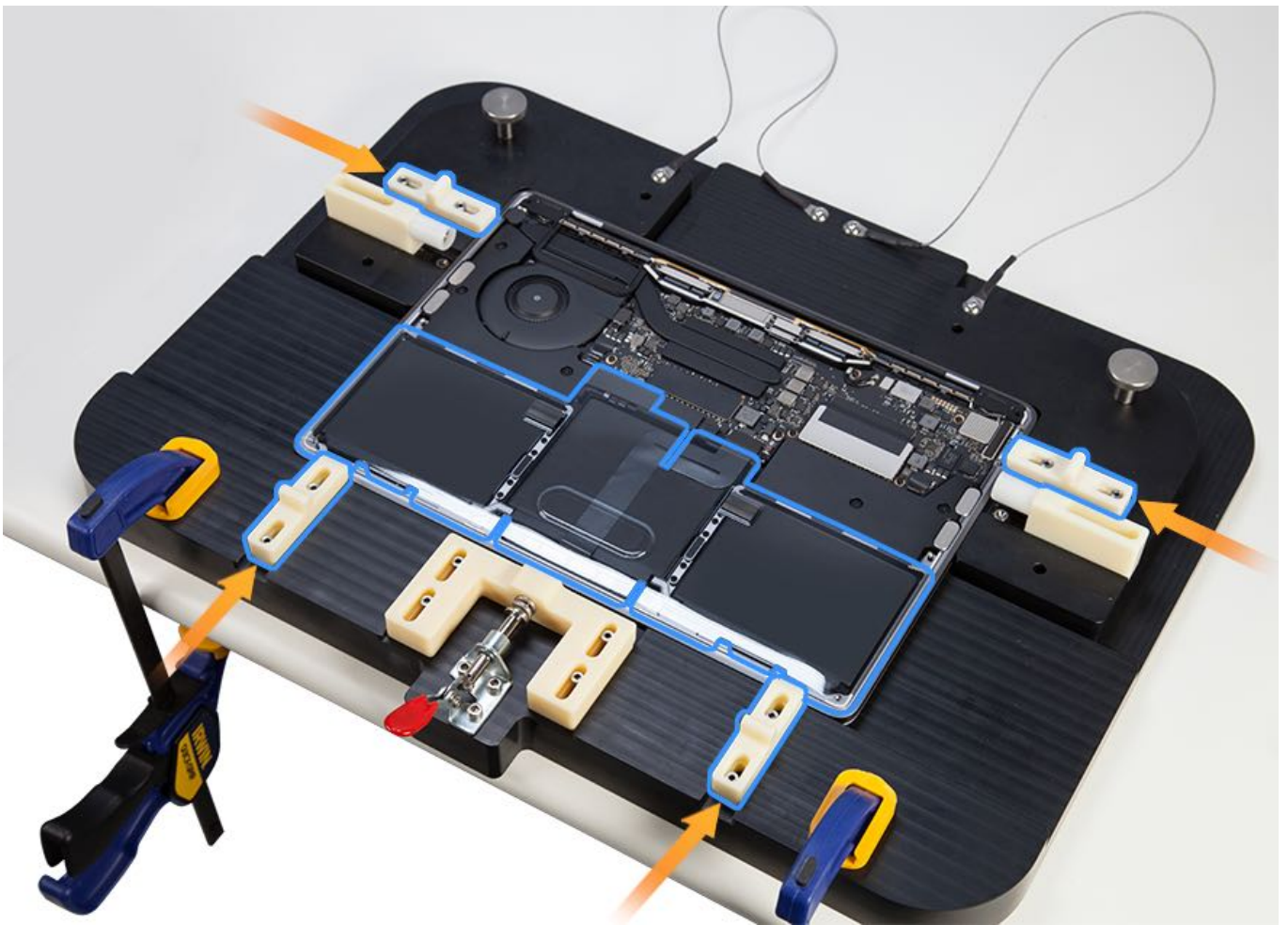


3. Retain the original bottom case until you complete the repair. Use a fine-tip permanent marker to write the system serial number on the inside of the replacement bottom case.

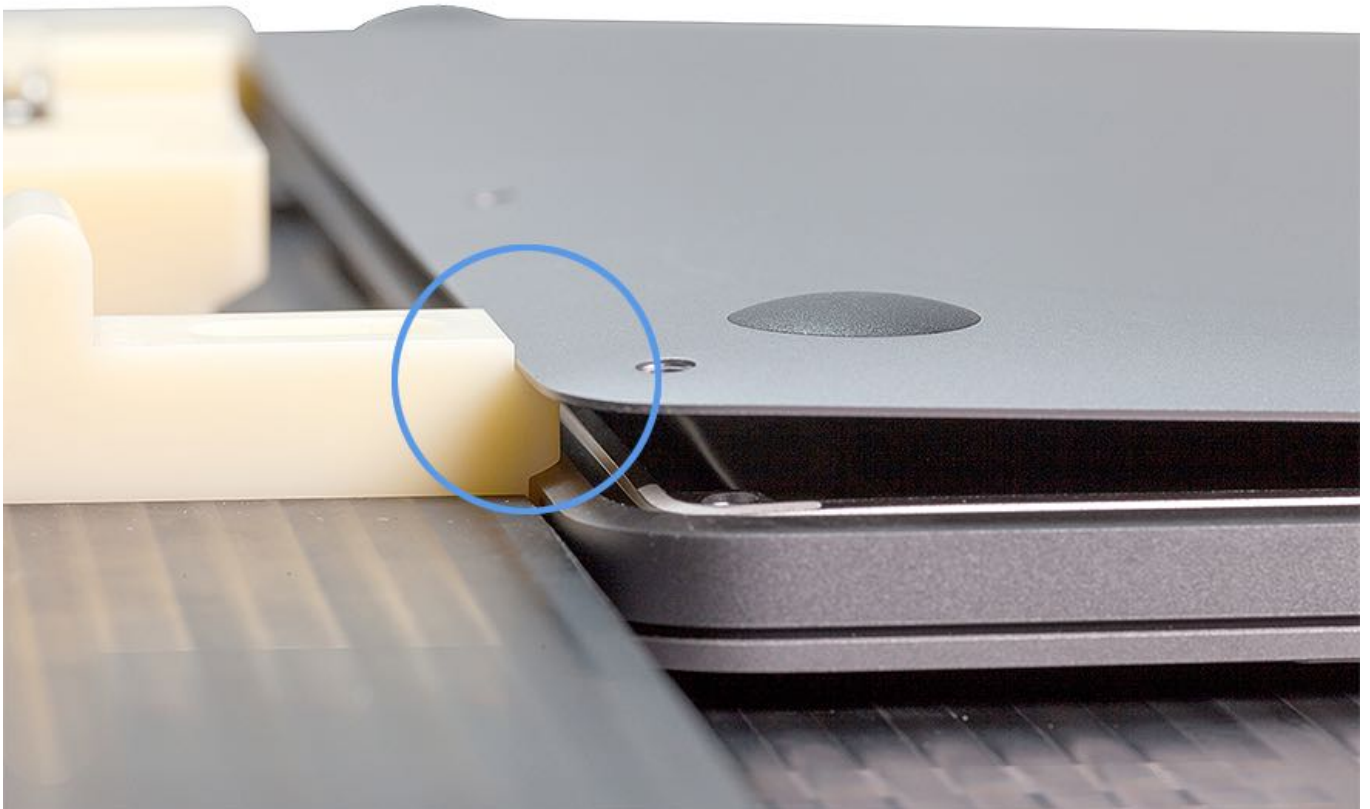




4. Reconnect the battery cable. Then place the computer on the bottom case fixture. Ensure that the display hinge is at the top, away from you.
5. Engage the four sliding locks.
6. Remove the battery cover.



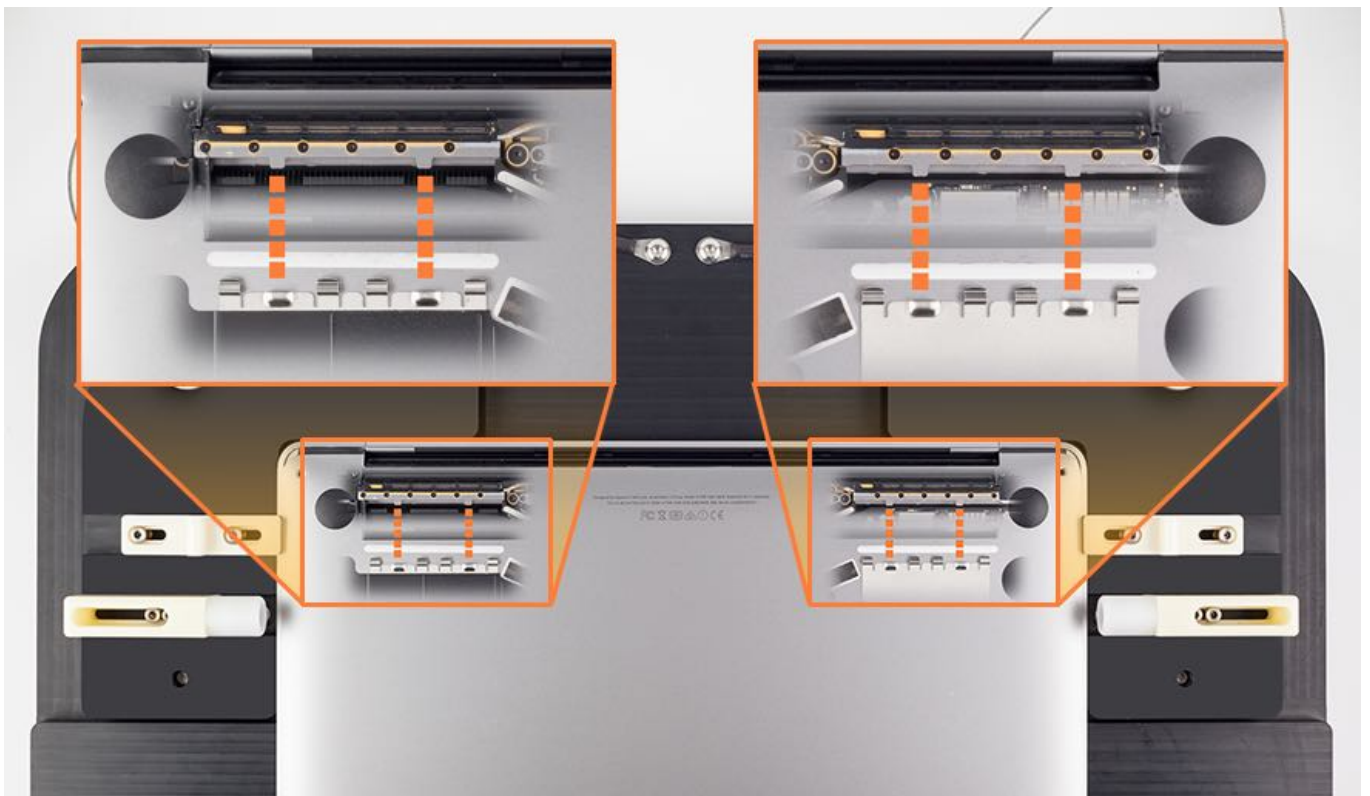
7. Position the bottom case so that its front edge rests on the shelf of the lower two sliding locks.



8. Align the back of the bottom case with the vent/antenna module. The long edge of the bottom case should be flush with the smooth plane of the vent/antenna module.

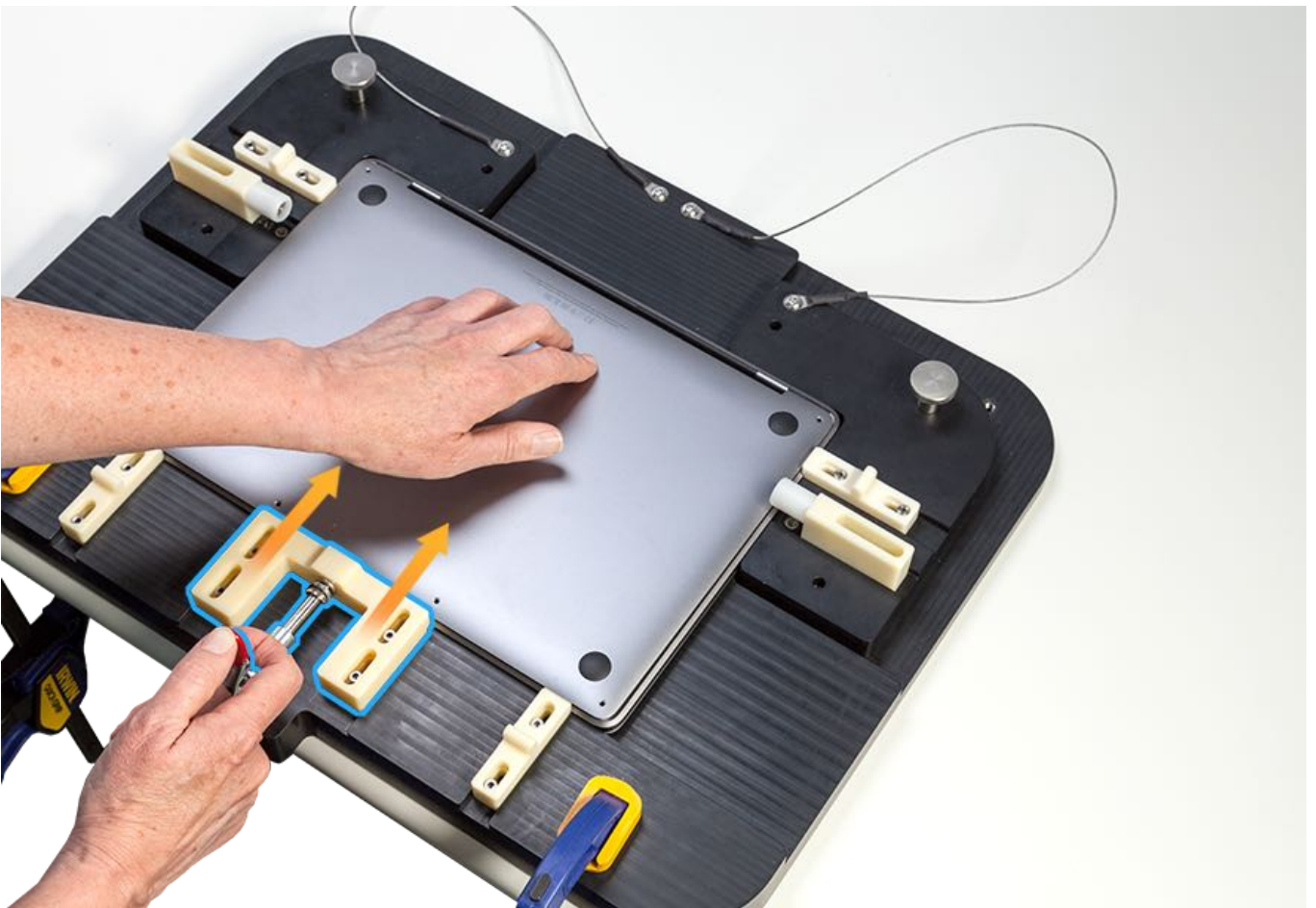


Important: The notches at each rear corner should show an equal gap, indicating that the two rows of spring fingers inside the bottom case are aligning with the metal tabs on the vent wall.



9. Lightly press near the back center edge of the bottom case while slowly engaging the red lever. Feel the spring fingers engage slightly as you press the bottom case.

Caution: Pushing the red lever all the way can distort the bottom case and the lever spring.

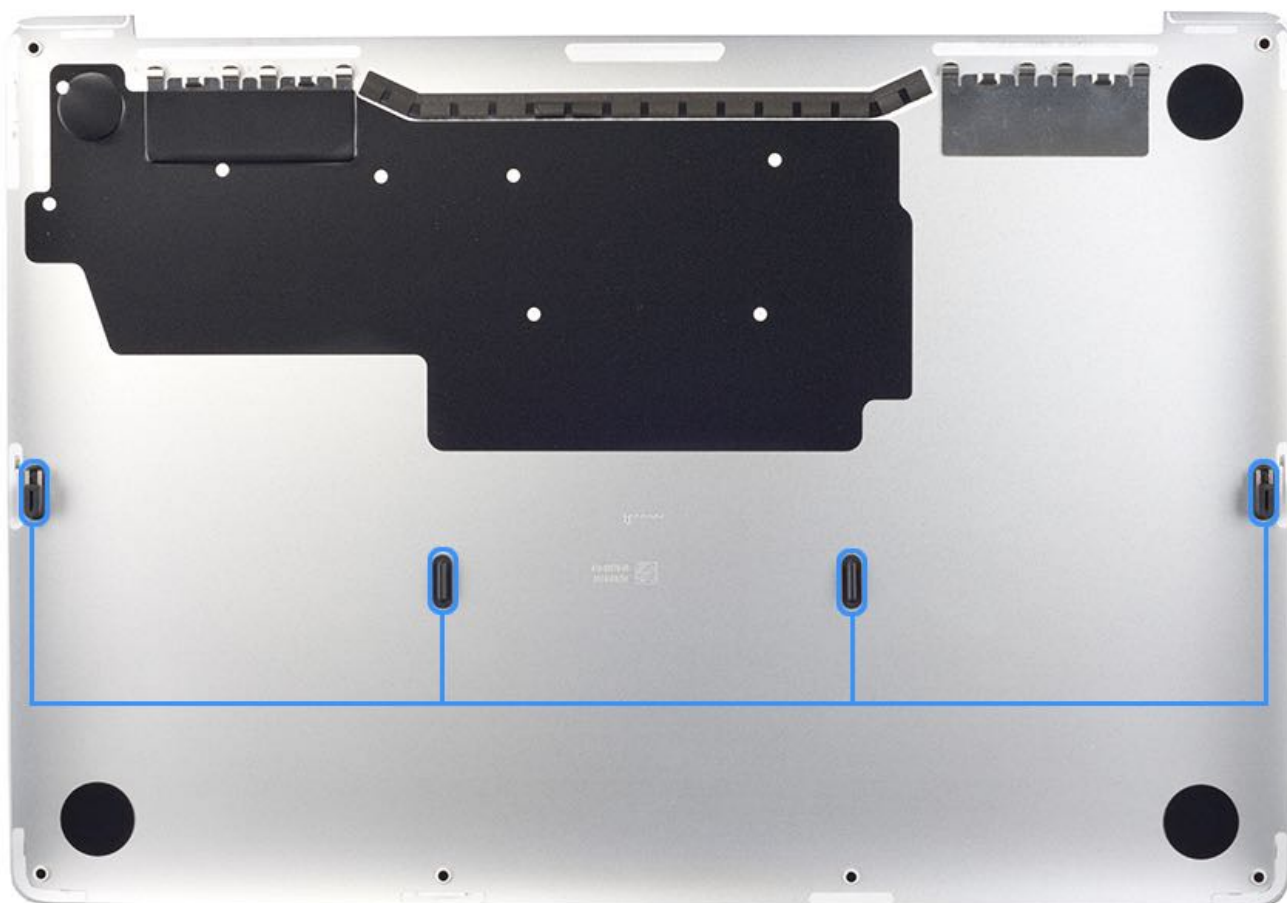
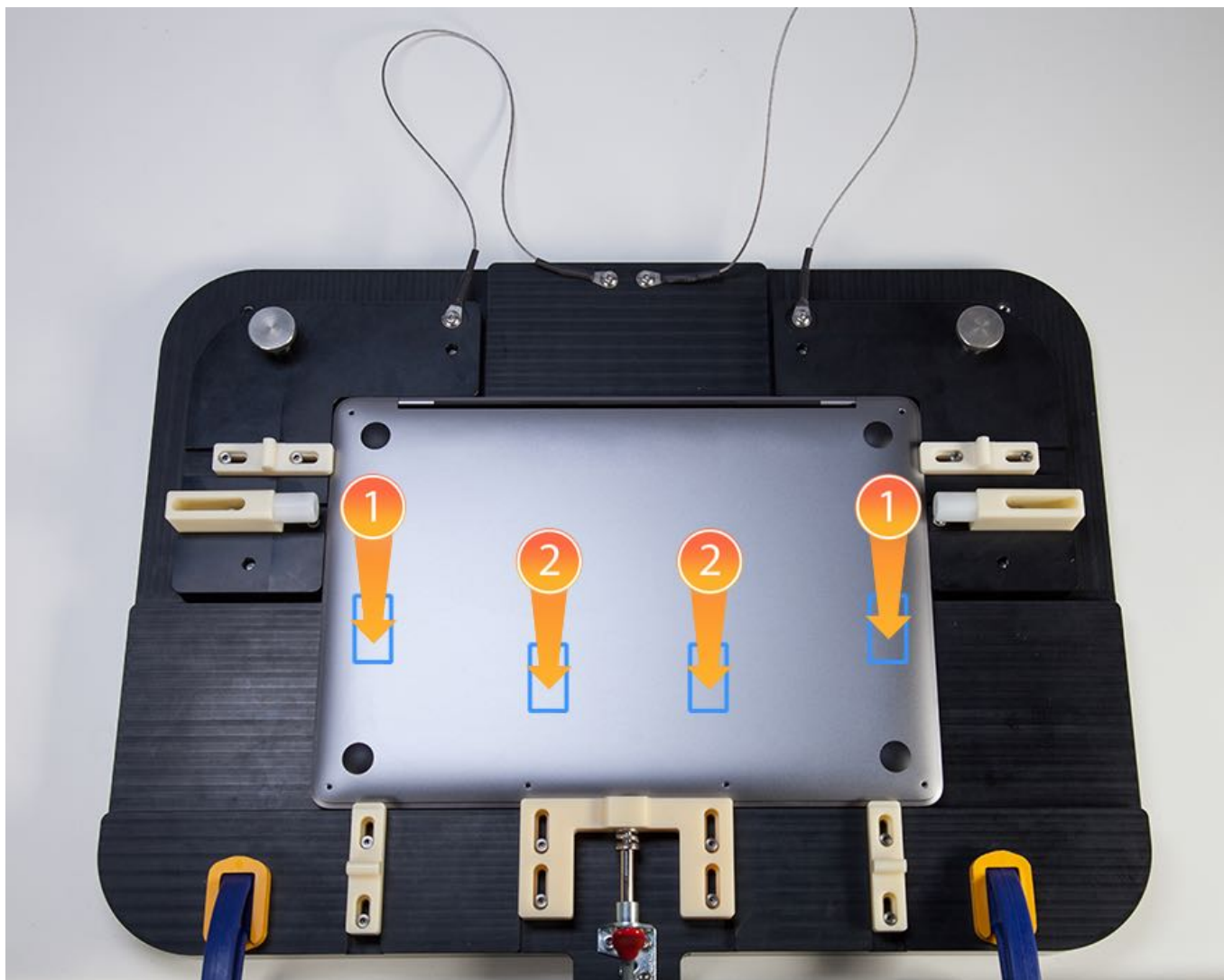


10. Disengage the lever as the rear corners of the bottom case meet the top case corners.

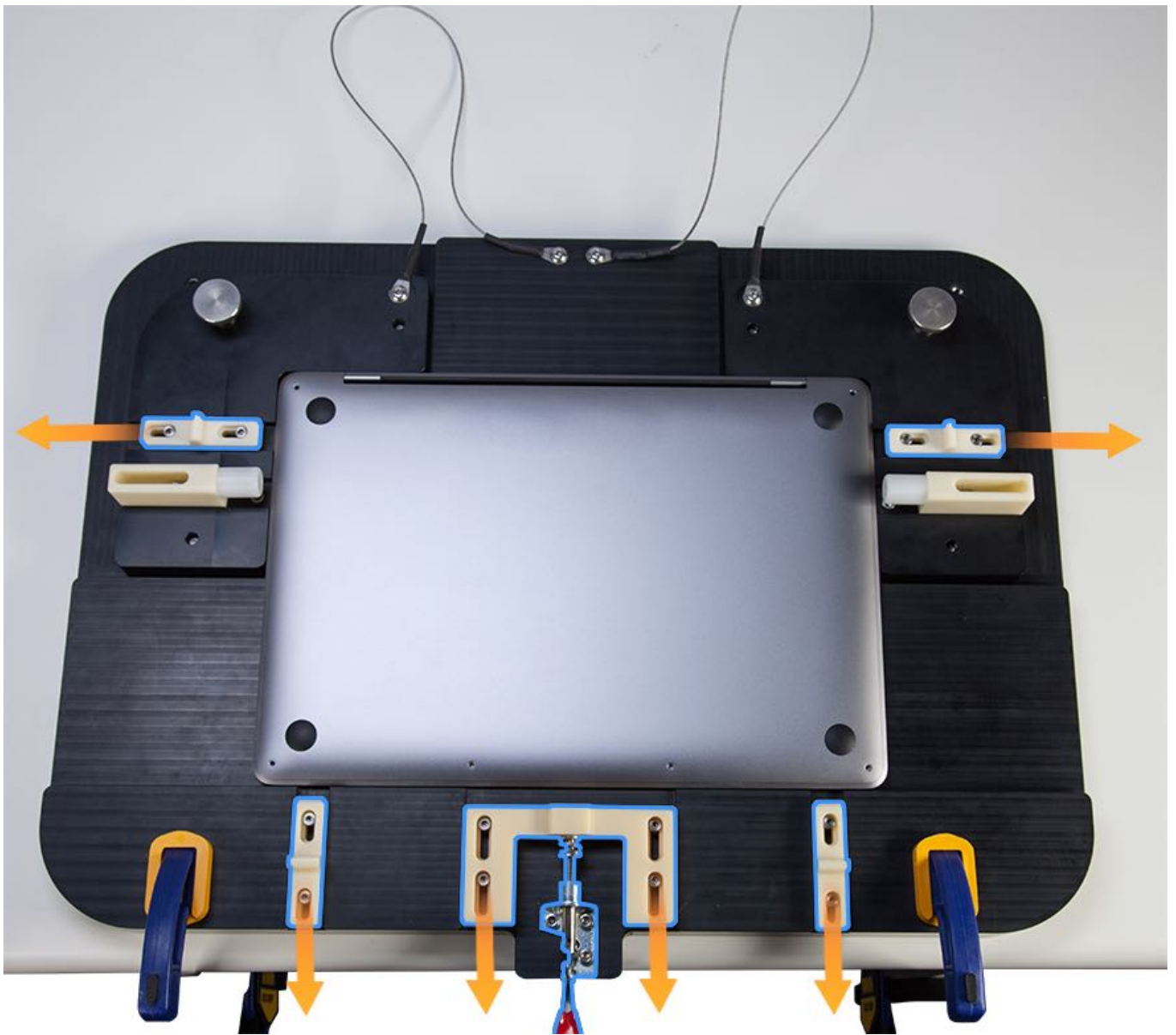
11. If the bottom case is slightly misaligned, wear gloves and gently press the bottom case to adjust it into alignment. If applying pressure doesn't realign the bottom case, remove the bottom case and go back to step 7.



12. First press the sides of the bottom case to reattach the two interior clips (1) in the top case. Then press the middle of the bottom case to reattach the remaining two interior clips (2).

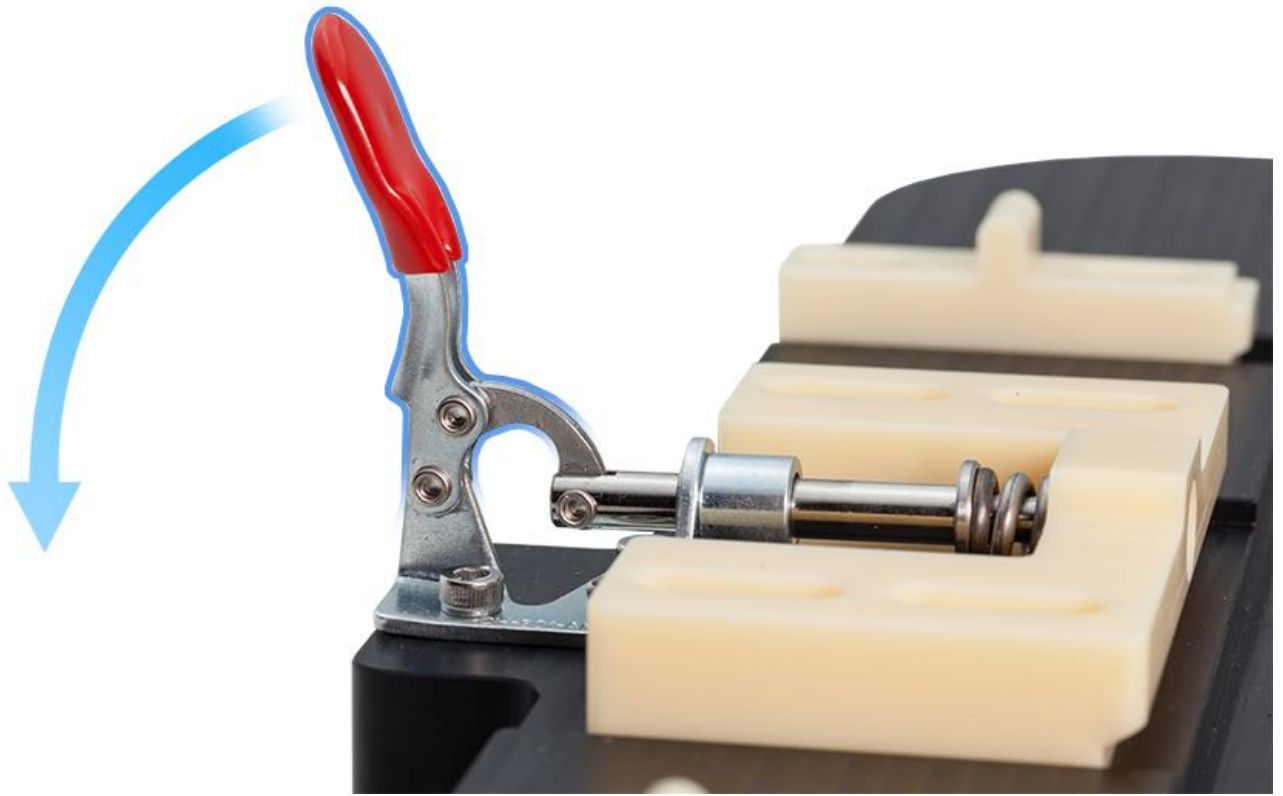


13. Push the four sliding locks outward. Pull the red lever to release the final lock.



14. Remove the computer from the bottom case fixture.

Note: Fully disengage the red lever to protect its inner spring when storing the bottom case fixture.



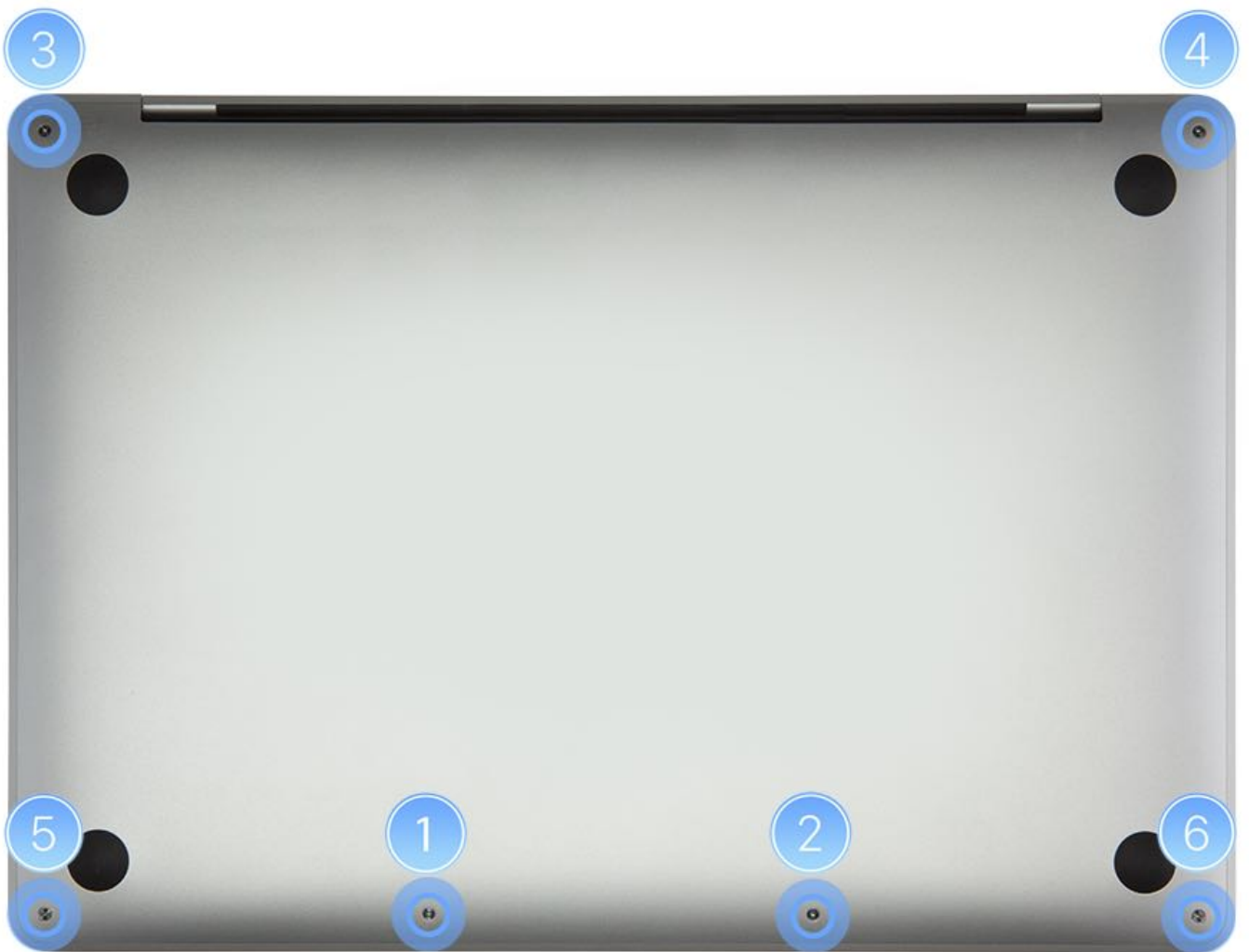
15. Check all sides of the bottom case for proper alignment with the top case.



16. Reinstall the six screws in the bottom case in the order shown:

- Short screws at the middle front (1), (2)
- Long screws at the rear corners (3), (4)
- Medium-length screws at the front corners (5), (6)

Note: MacBook Pro (13-inch, 2016, 2017, 2018, 2019, 2020, Four Thunderbolt 3 Ports), MacBook Pro (15-inch, 2016, 2017, 2018, 2019), and MacBook Pro (16-inch, 2019) only have two screw sizes but the reinstallation order is the same as above.



17. Run the [Trackpad Calibration Check](#) .

MacBook Pro (13-inch, 2020, Two Thunderbolt 3 Ports) Battery Cover and Disconnecting the Battery

First Steps

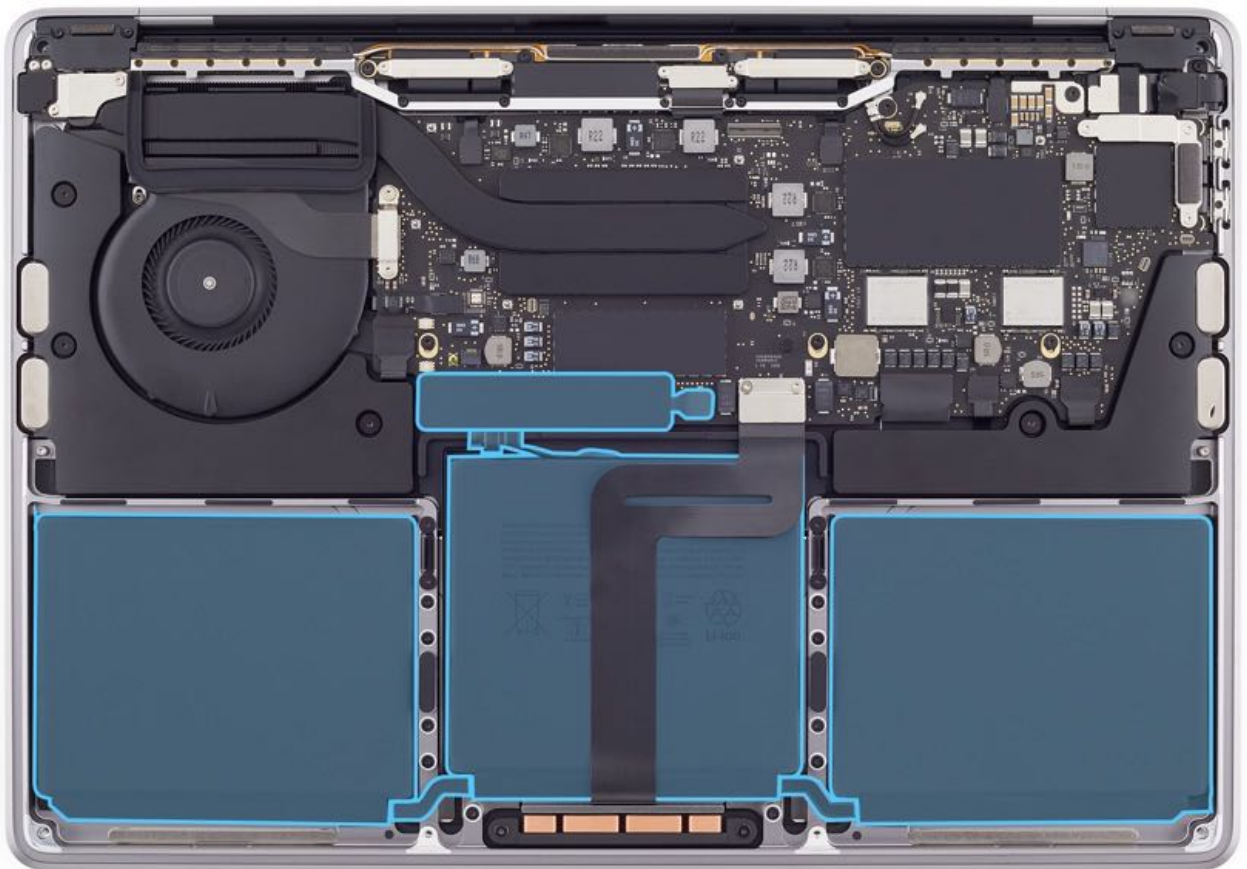


Caution:

- Only [Apple-certified technicians](#) should perform this procedure.
- To avoid damaging parts, complete the removal steps of this procedure before you begin any other repair.
- Do not apply external power while the computer is under repair.
- Wear an ESD wrist strap and take precautions to avoid ESD.

Remove:

- [Bottom Case](#)



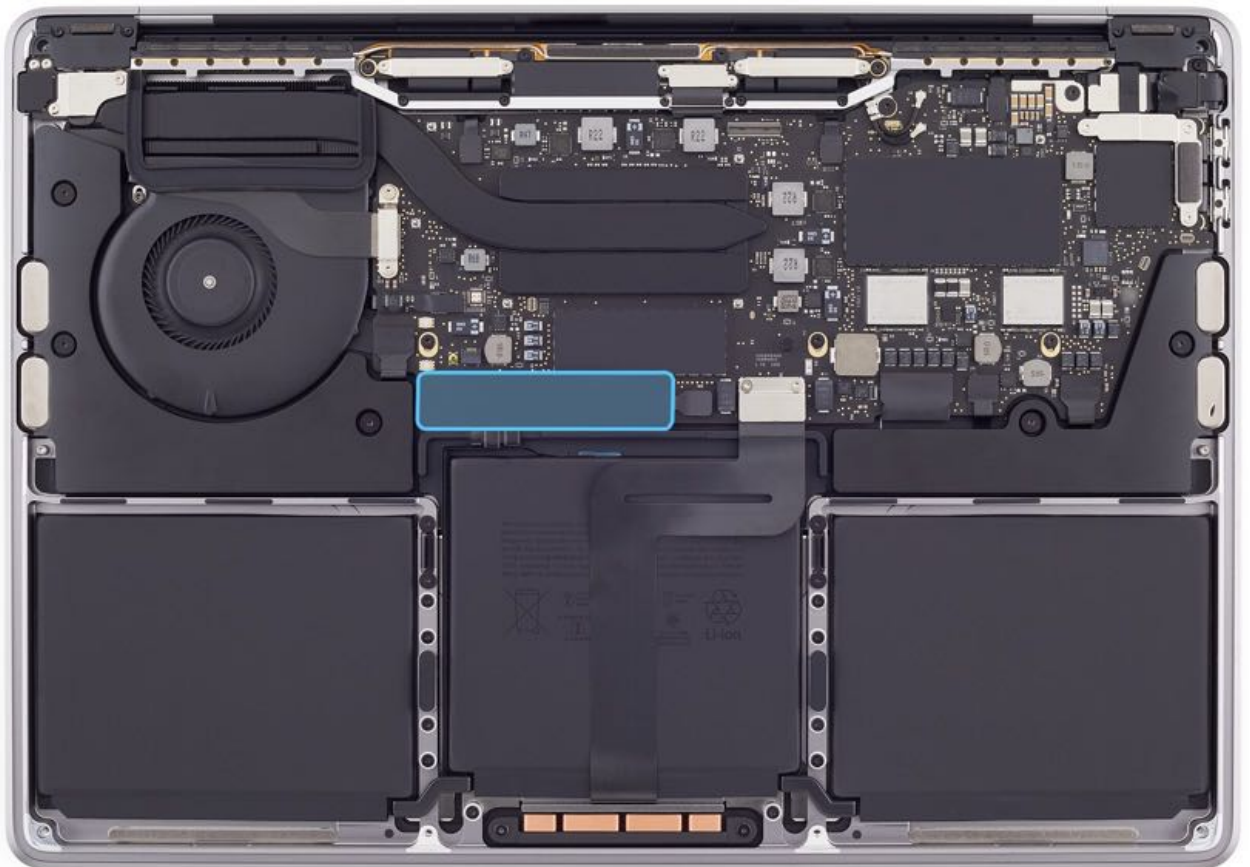
Tools

1. Black stick
2. Torx T5 screwdriver
3. Tweezers (optional)
4. ESD wrist strap
5. Battery cover (923-01318)

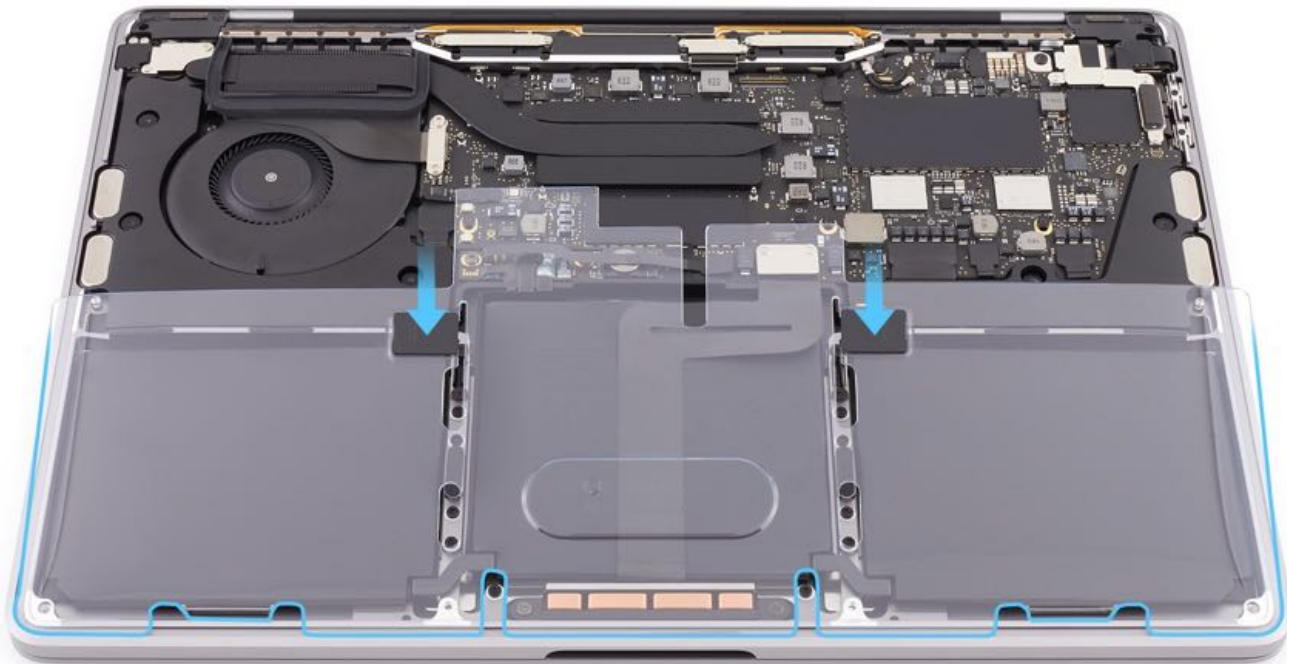


Steps For Removal

1. The battery management unit (BMU) Mylar cover is held in place by adhesive foam pads. Use the flat end of a black stick to lift the BMU Mylar cover off the BMU board, then set it aside for reuse.
Important: Some replacement parts include a new BMU Mylar cover. Always install a new BMU Mylar cover if one is provided.



2. Tuck the bottom edge of the battery cover under the edge of the top case. Press down on the clips to attach the battery cover to the top case.



3. Peel up the pull tab (1) covering the locking lever on the BMU flex cable connector. Use a black stick to flip up the locking lever on the connector, then disconnect the BMU flex cable (2).



4. Remove the T5 screw from the BMU board.



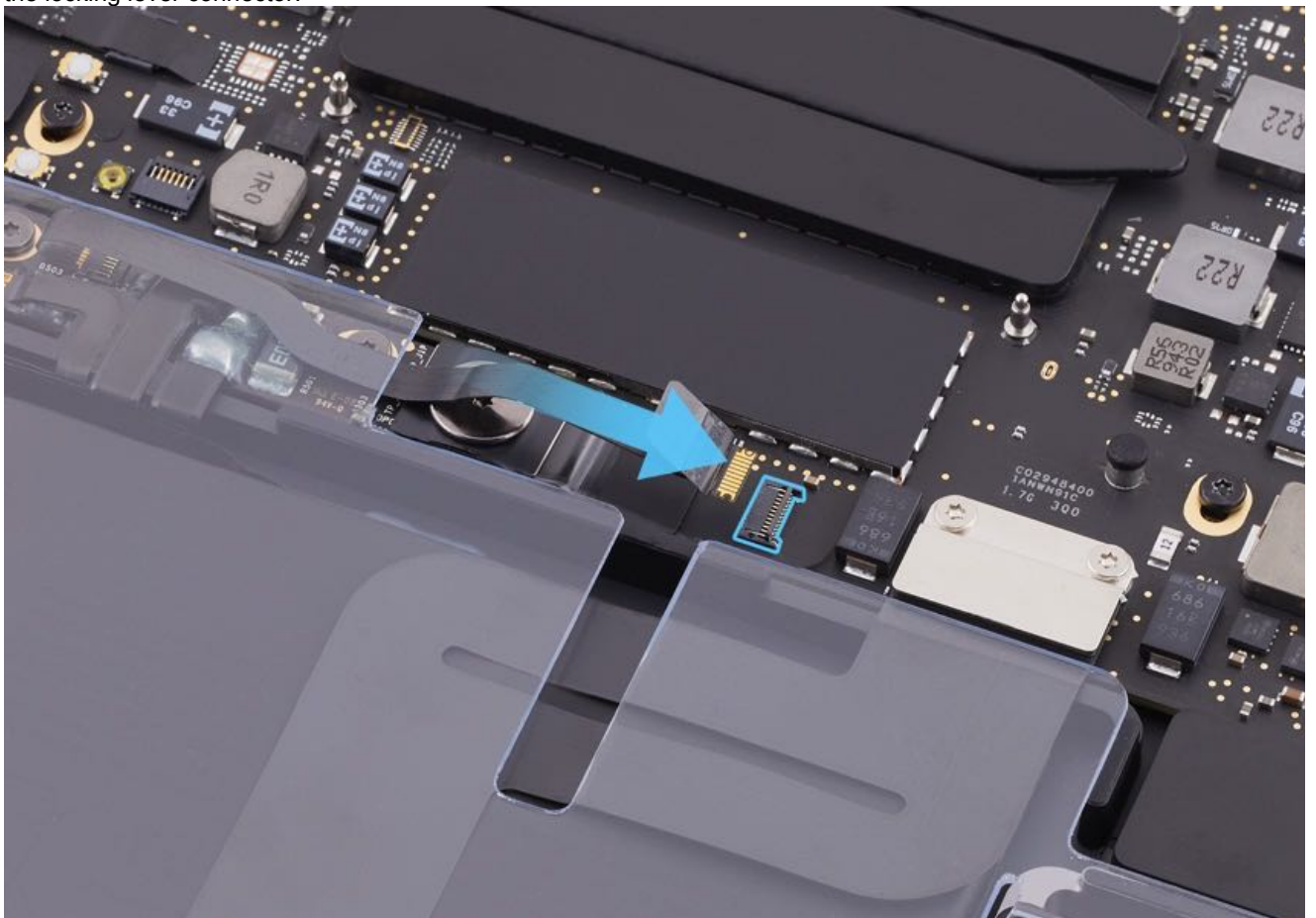
Steps For Reassembly

1. Reinstall the T5 screw (923-01189) in the BMU board.





2. Reconnect the battery flex cable. Use the flat end of a black stick to close the locking lever. Reattach the pull tab over the locking lever connector.

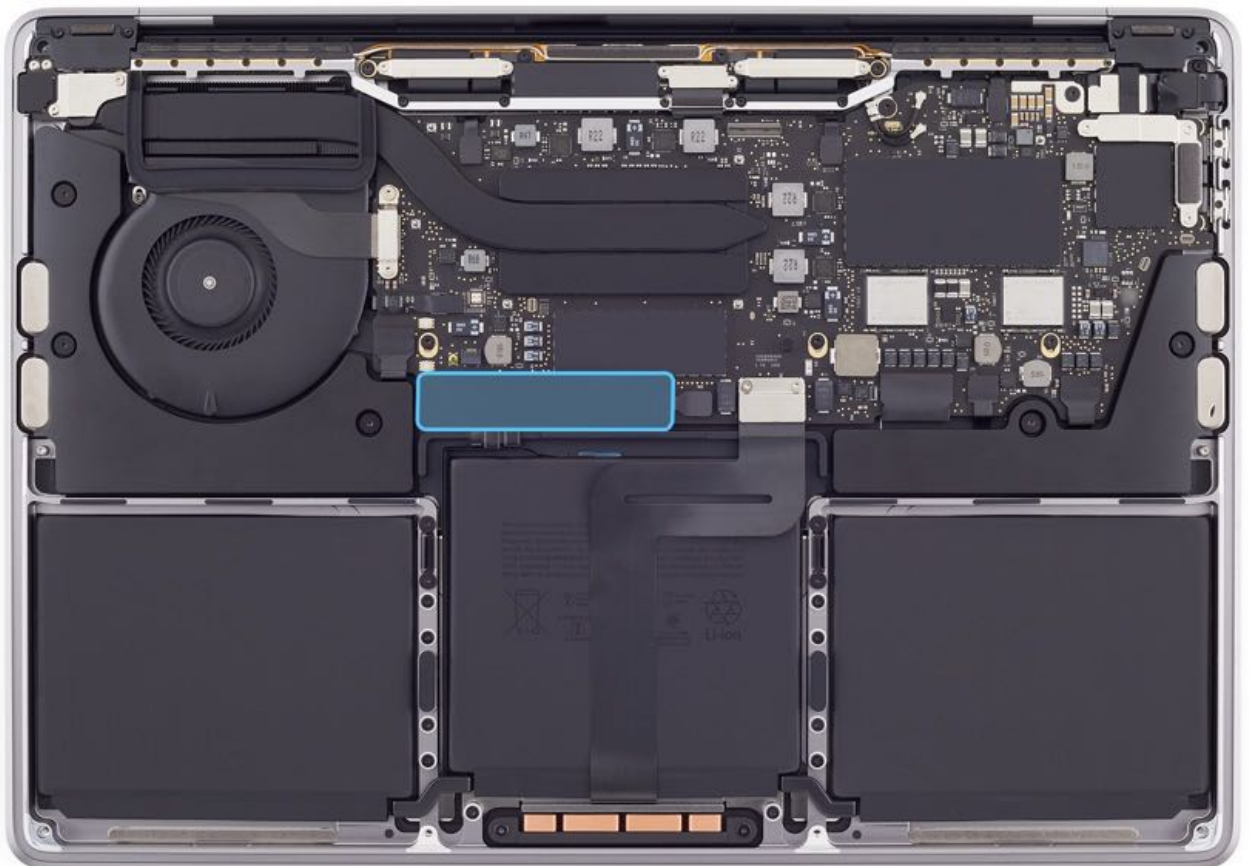


Note: If installing a new BMU flex cable, remove the blue adhesive backing from the pull tab before adhering the pull tab to the locking lever connector.



3. Remove the battery cover and reinstall the BMU Mylar cover.

Important: Some replacement parts include a new BMU Mylar cover. Always install a new BMU Mylar cover if one is provided.



4. Reinstall the [bottom case](#).

Repair Completion:

5. [System Configuration](#) must be performed after a [logic board](#), [Touch ID board](#), [display](#), and [top case](#) repair.
6. Perform the [Trackpad Calibration Check](#) to verify trackpad performance after every repair.

Post Repair Verification:

7. After repair completion, verify the repair was successful by running the [required AST 2 diagnostics based on the repair module that was replaced](#)

MacBook Pro (13-inch, 2020, Two Thunderbolt 3 Ports) Battery Management Unit (BMU) Flex Cable

First Steps

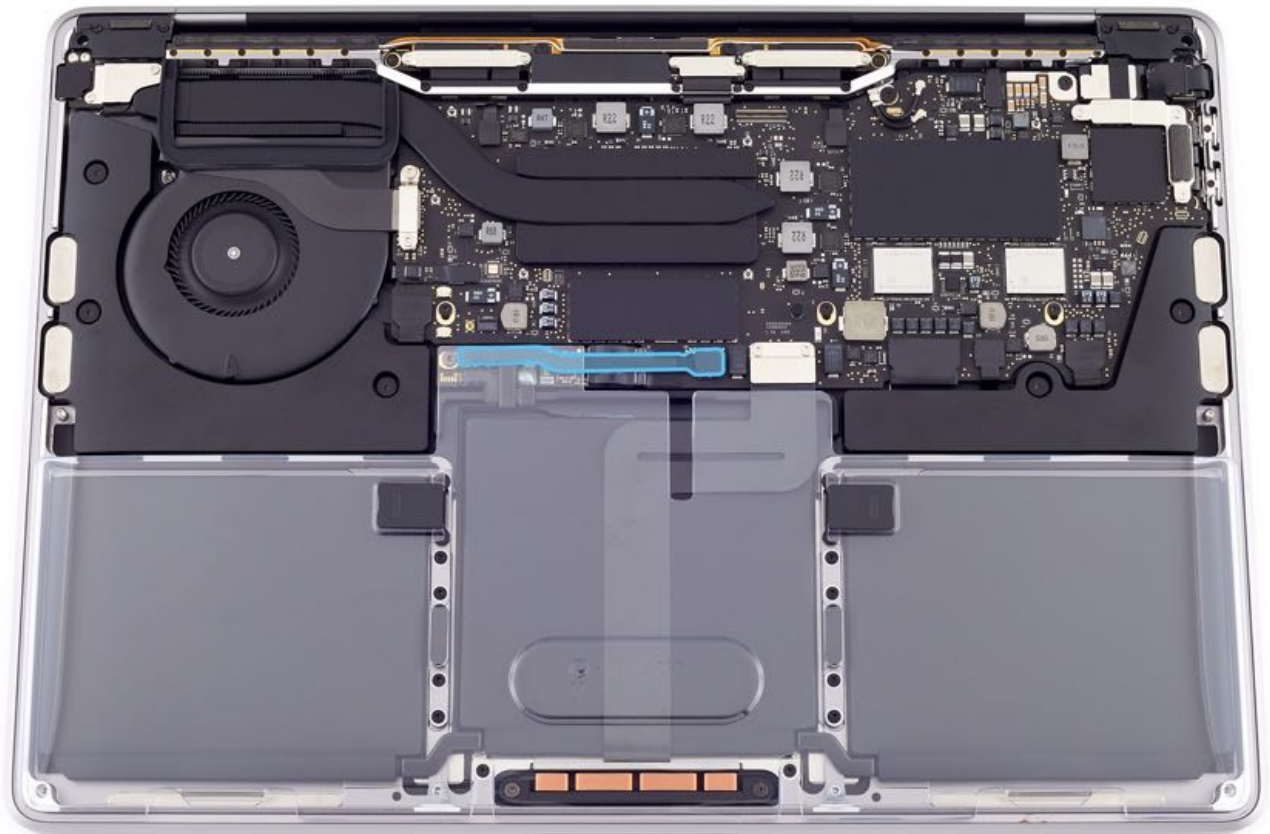


Caution:

- Only [Apple-certified technicians](#) should perform this procedure.
- To avoid damaging parts, ensure that you have [attached the battery cover and disconnected the battery](#) .
- Do not apply external power while the computer is under repair.
- Wear an ESD wrist strap and take precautions to avoid ESD.

Remove:

- [Bottom Case](#)
- [Attach the Battery Cover and Disconnect the Battery](#)



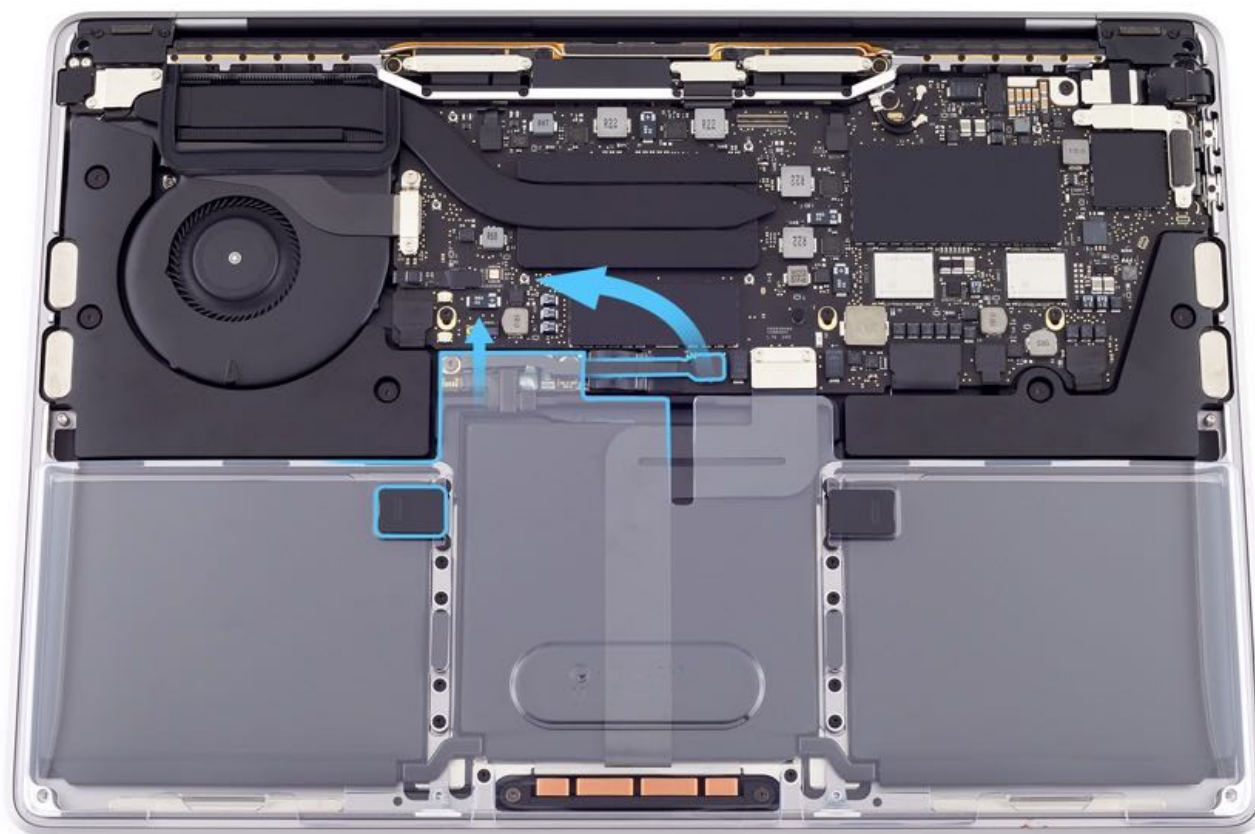
Tools

1. ESD wrist strap
2. Black stick
3. Tweezers



Steps For Removal

1. To access the locking lever connector on the battery management unit (BMU) board, slightly lift the battery cover and unfold the BMU flex cable toward the fan.

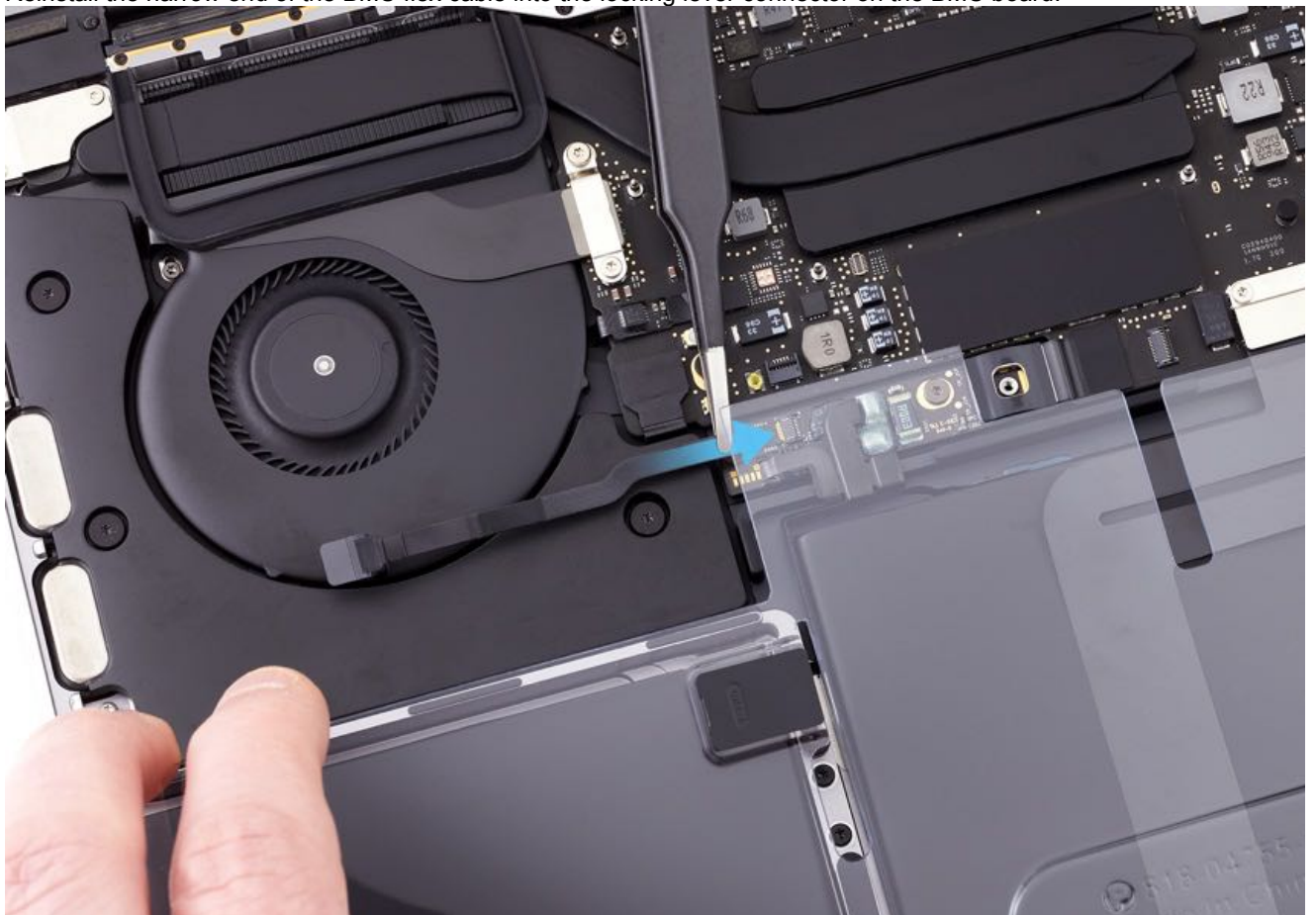


2. Use a black stick to flip the locking lever up, then gently remove the flex cable from the connector.

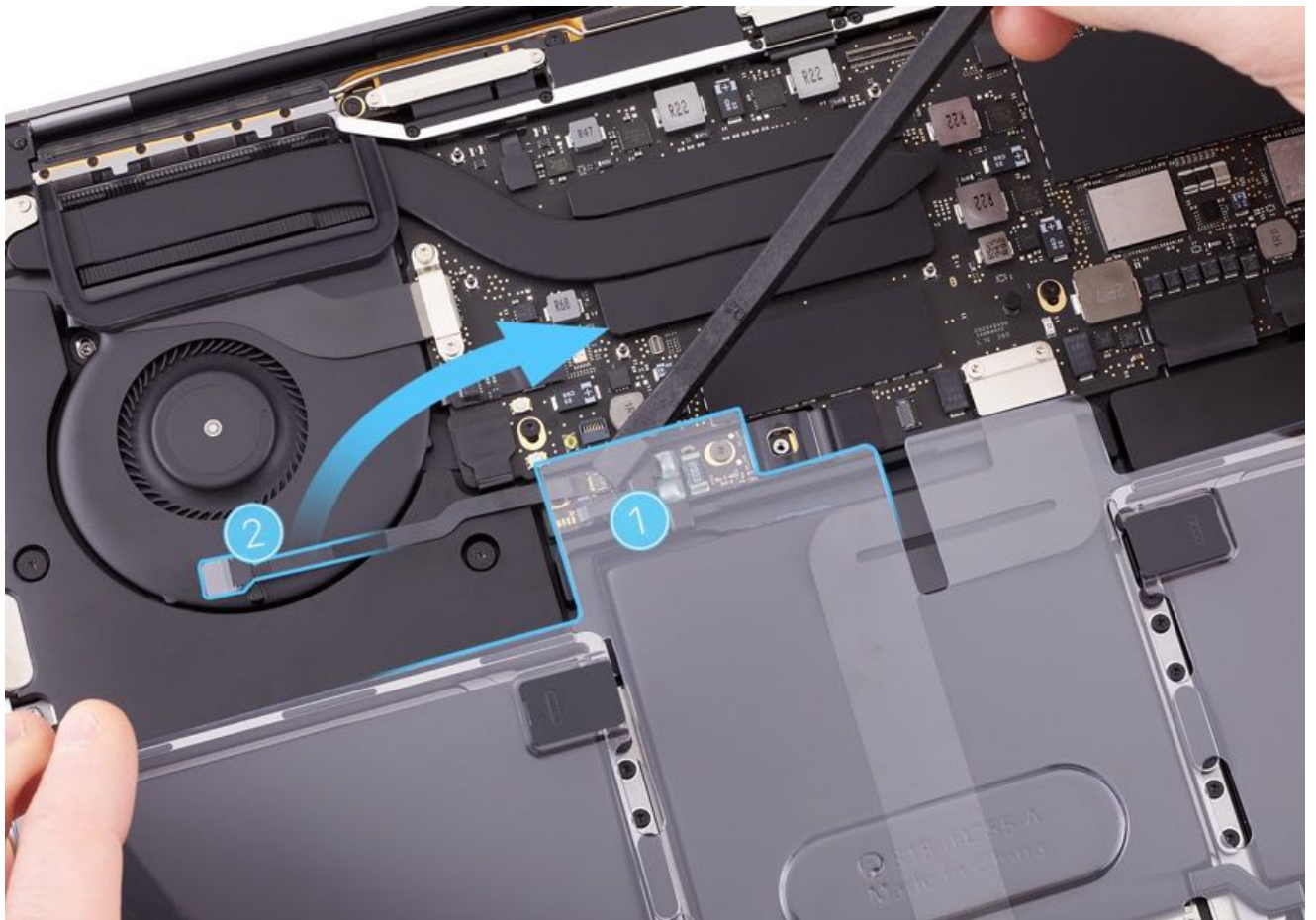


Steps For Reassembly

1. Reinstall the narrow end of the BMU flex cable into the locking lever connector on the BMU board.



2. Use a black stick to close the locking lever, then slightly lift the battery cover and fold the BMU cable back toward the logic board.



3. [Reconnect the battery and remove the battery cover.](#)
4. Reinstall the [bottom case](#).

Repair Completion:

5. [System Configuration](#) must be performed after a [logic board](#), [Touch ID board](#), [display](#), and [top case](#) repair.
6. Perform the [Trackpad Calibration Check](#) (TP1314) to verify trackpad performance after every repair.

Post Repair Verification:

7. After repair completion, verify the repair was successful by running the [required AST 2 diagnostics based on the repair module that was replaced](#).

MacBook Pro (13-inch, 2020, Two Thunderbolt 3 Ports) Logic Board

First Steps



Caution:

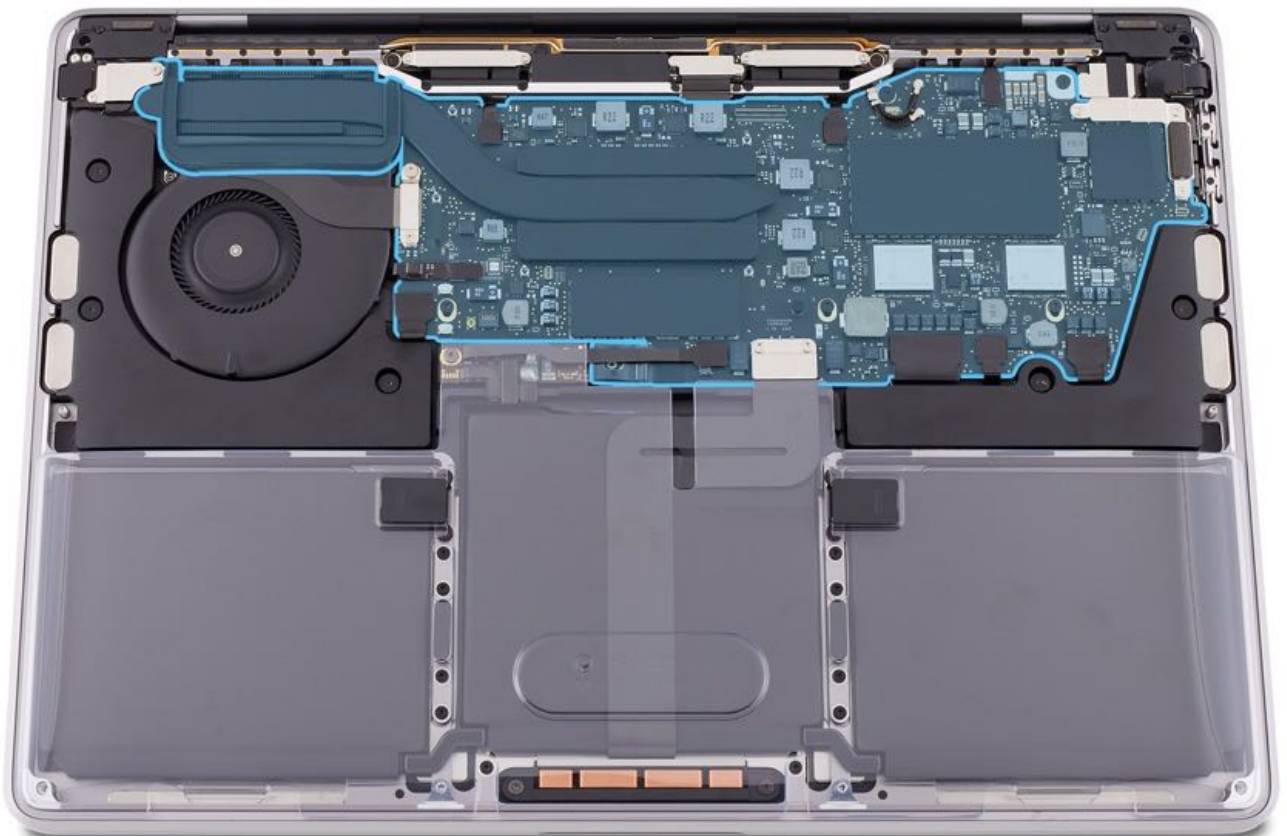
- Only [Apple-certified technicians](#) should perform this procedure.
- To avoid damaging parts, you must [attach the battery cover and disconnect the battery](#). Wait one minute for the logic board to discharge before proceeding.
- Don't connect the computer to any external power source during repair.
- Wear an ESD wrist strap and take precautions to avoid ESD.

System Configuration:

- If you replace the logic board, you **must also** replace the [Touch ID board](#). But if you reinstall the same logic board, you don't need to replace the Touch ID board.
- Run the [System Configuration Suite](#). **Caution:** If you don't run the System Configuration Suite after you replace a [logic board](#), [Touch ID board](#), [display](#), or [top case](#), the computer will be unresponsive.

Remove:

- [Bottom Case](#)
- [Attach the Battery Cover and Disconnect the Battery](#)



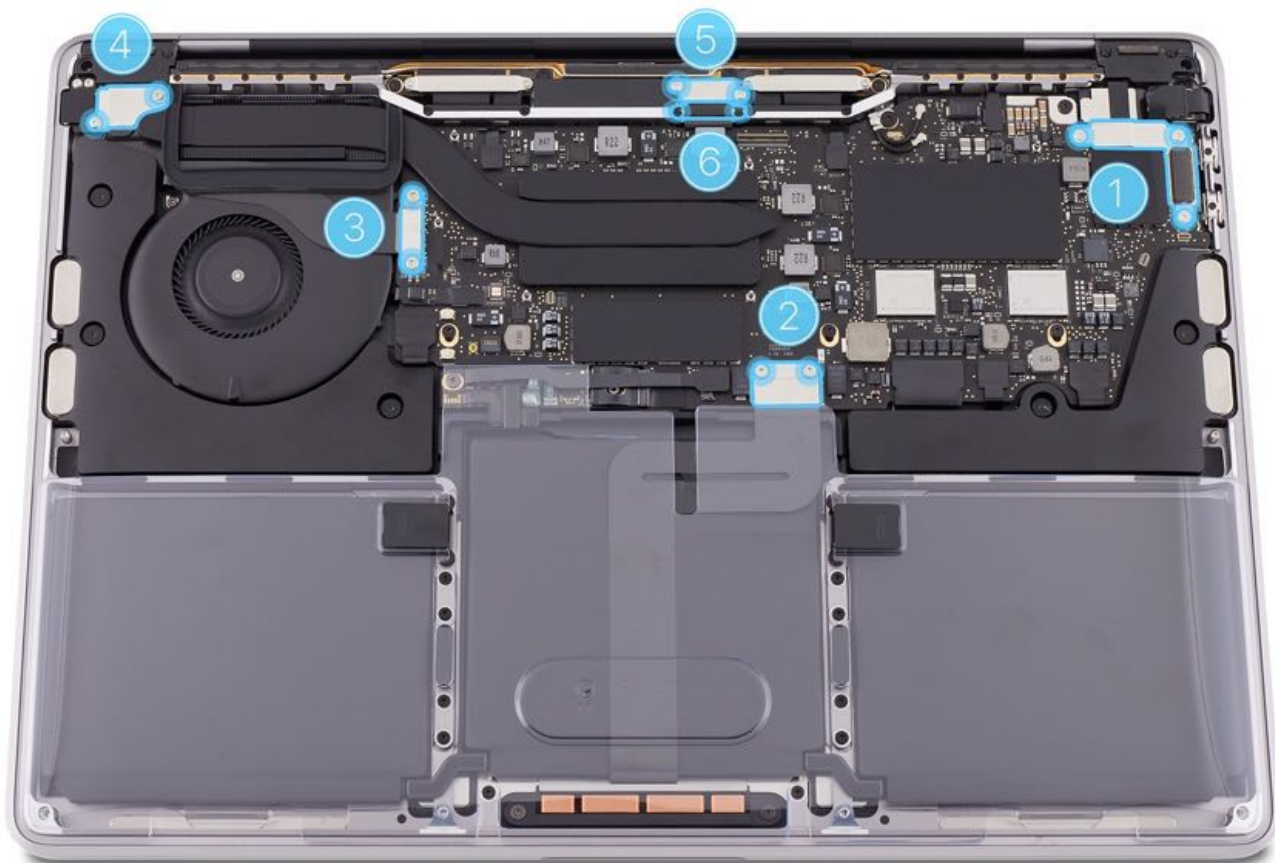
Tools

1. Antenna tool (923-01322)
2. Black stick
3. ESD-safe tweezers
4. Torx T3 screwdriver
5. Torx T5 screwdriver
6. 3 mm hex nut driver



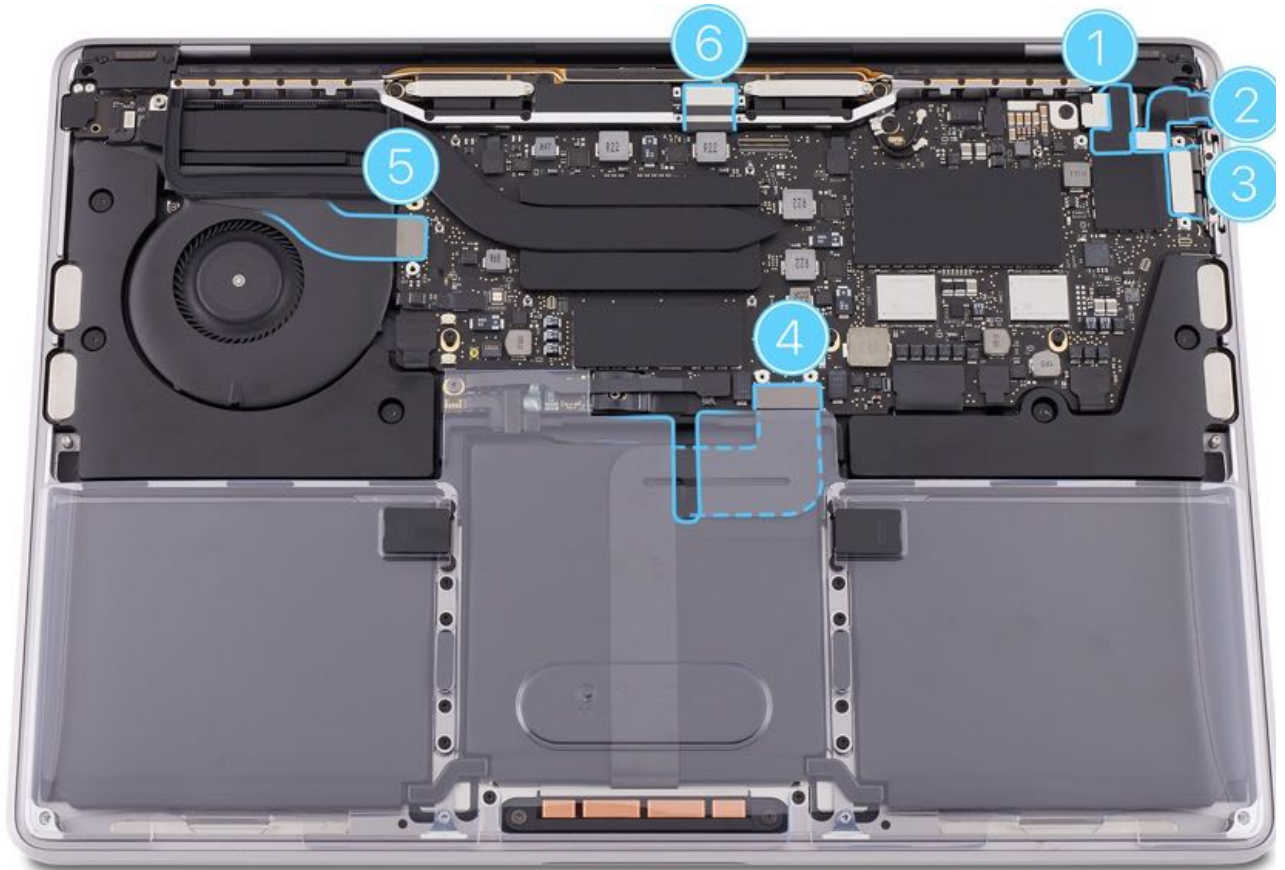
Steps For Removal

1. Remove 13 screws from six cowlings. Then remove the six cowlings.
 1. Three T3 screws from the L-shaped cowing.
 2. Two T5 screws from the trackpad flex cable cowing.
 3. Two T5 screws from the audio board flex assembly cowing.
Important: The audio board flex assembly cowing (3) has a deeper bend where the upper screw is located. Remember the orientation of the cowing for reinstallation.
 4. Two T3 screws from the Touch ID board cowing.
 5. Two T3 screws from the embedded DisplayPort (eDP) connector cowing.
 6. Two T3 screws from the eDP flex cable cowing.

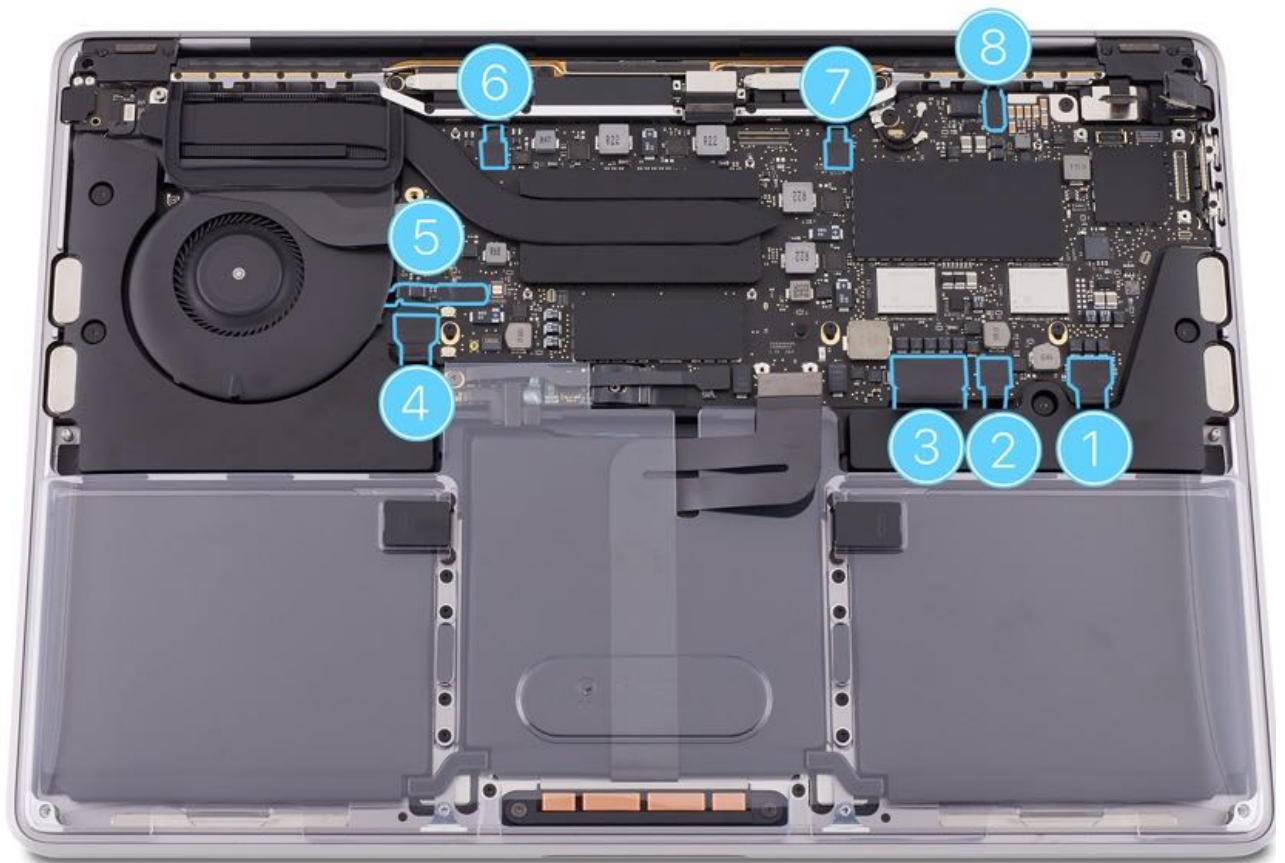


2. Disconnect five solid platform connector cables from the logic board (1-5) and one from the timing controller (TCON) board (6).
Important: Slightly lift the battery cover and thread the trackpad flex cable (4) through the slot in the battery cover. Ensure that the battery cover is fully reinstalled before continuing.
 1. Touch Bar touch
 2. Touch Bar display
 3. I/O board

4. Trackpad
5. Audio board flex assembly
6. eDP



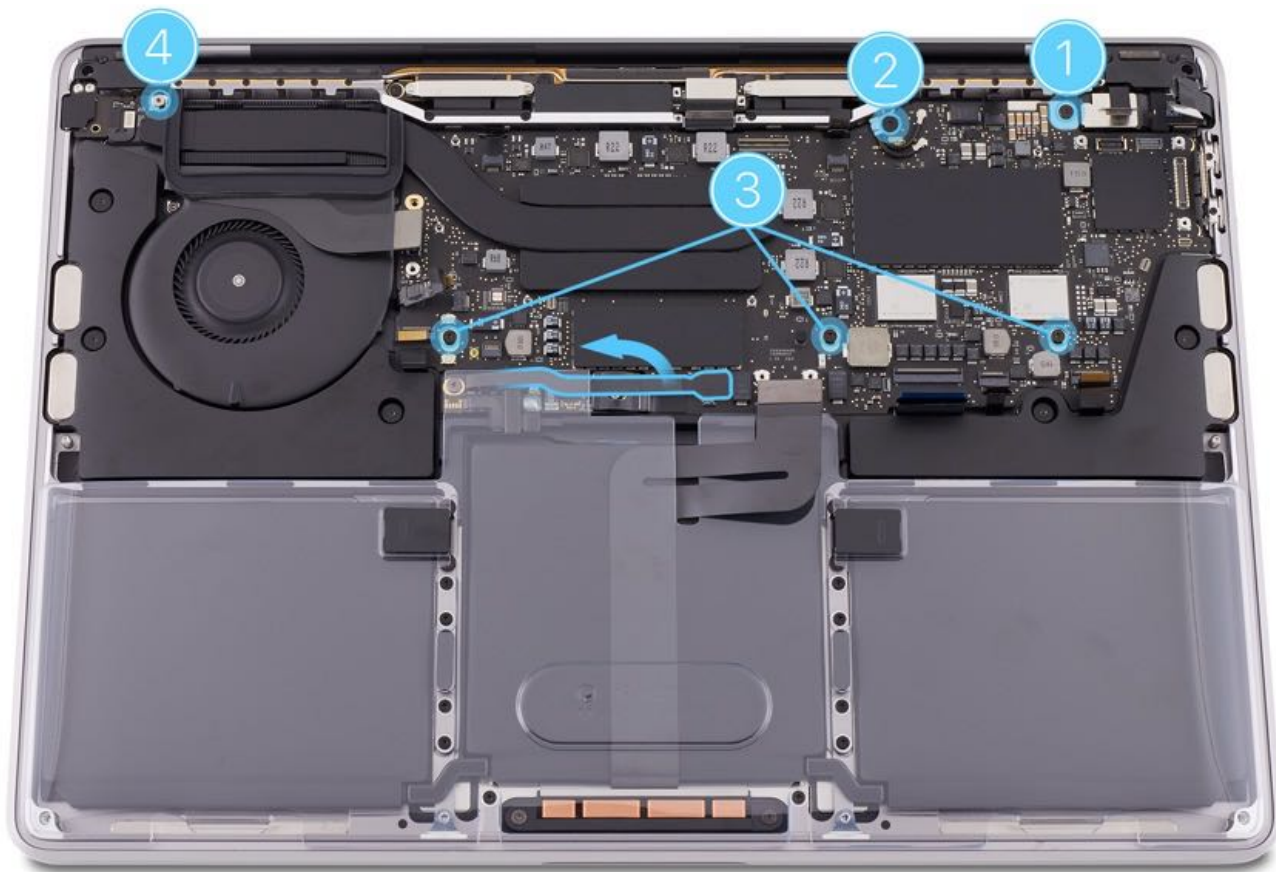
3. Carefully lift the pull tabs on the eight flex cables to reveal the locking lever connectors on the logic board. Use a black stick to lift the locking levers up. Then use the pull tabs to remove the eight flex cables from their connectors.
 1. Left speaker
 2. Keyboard backlight (power)
 3. Keyboard
 4. Right speaker
 5. Fan
 6. Keyboard backlight (right)
 7. Keyboard backlight (left)
 8. Microphone



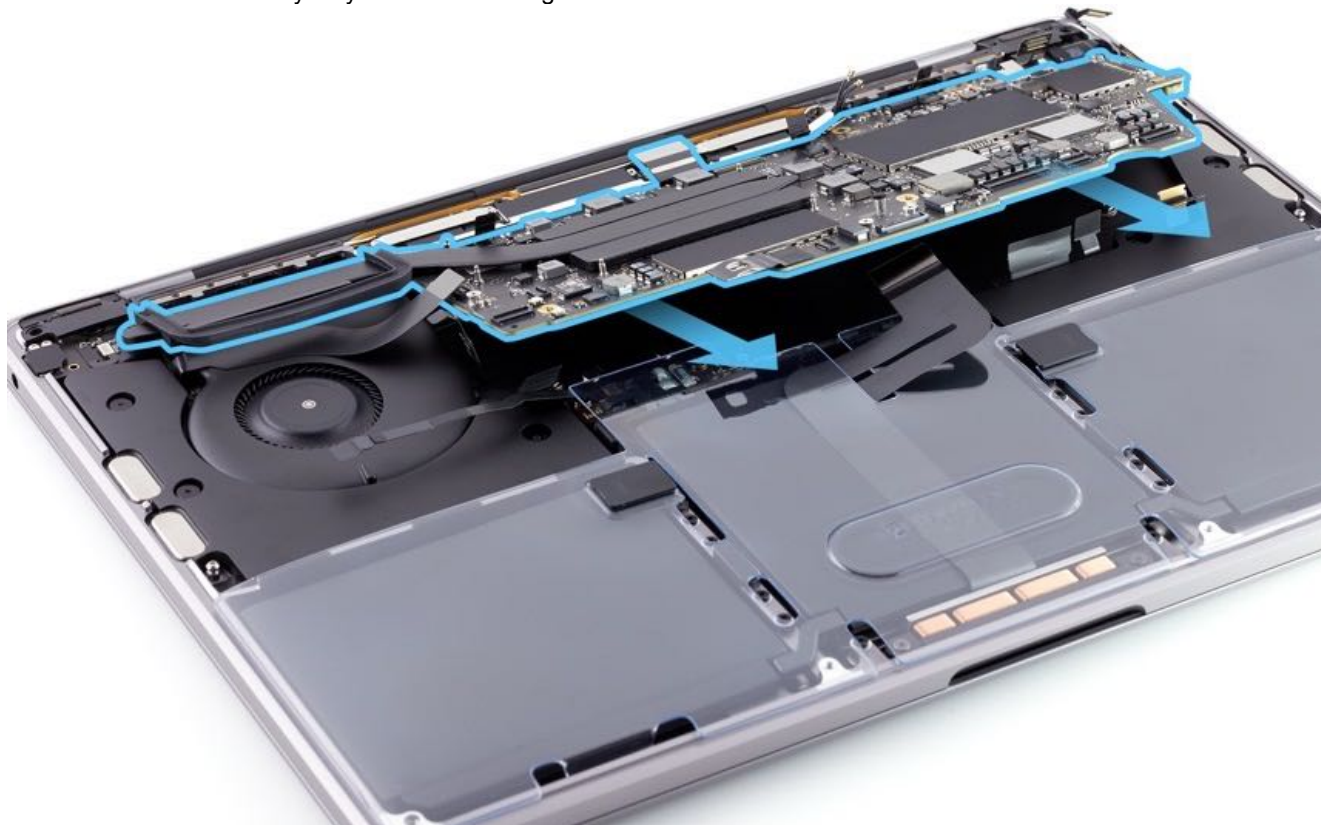
4. Remove and discard the Mylar cover to access the wireless antenna cables. Use the antenna tool to disconnect the two wireless antenna cables from the logic board.



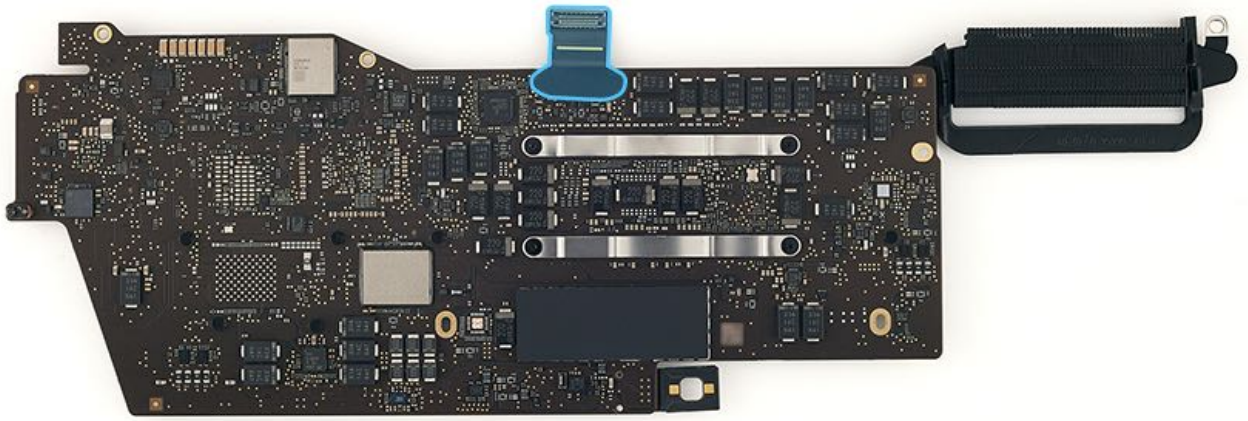
5. Remove five T5 screws from the logic board (1, 2, 3) and one 3 mm hex screw (4) from the heat sink arm.
Note: Slightly lift the top edge of the battery cover and unfold the BMU flex cable toward the fan. Ensure that the battery cover is fully reinstalled before continuing.



6. Slowly lift up the bottom edge of the logic board. Then carefully pull the logic board toward you and out of the top case. Move cables out of the way as you remove the logic board.



7. If you replace the logic board, remove and transfer the [eDP flex cable](#) to the new logic board.
Important: Always apply a new Mylar cover to the eDP cowling if one is provided with the replacement part.

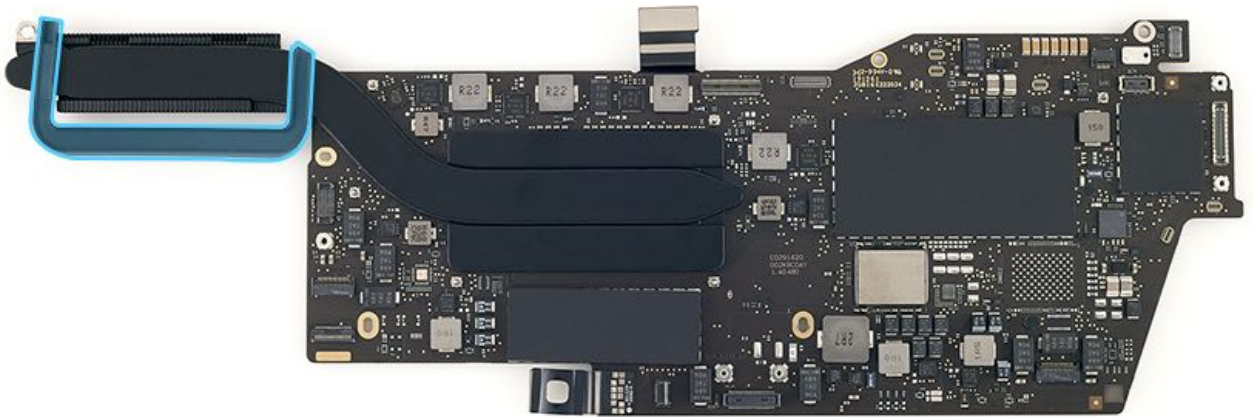


Steps For Reassembly

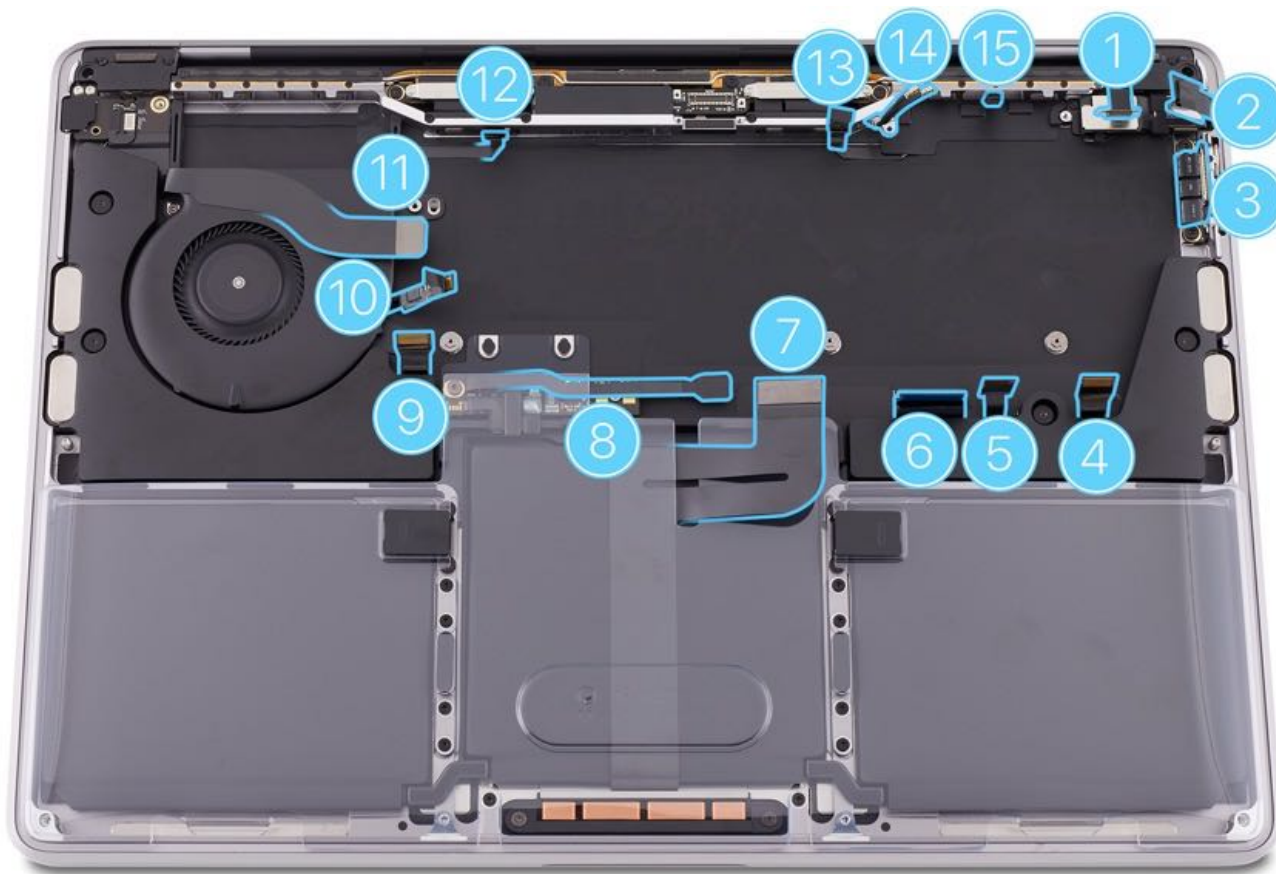


Important: Don't remove the heat sink. A replacement logic board comes with the heat sink installed.

1. Verify that the thermal duct is installed on the heat sink arm.



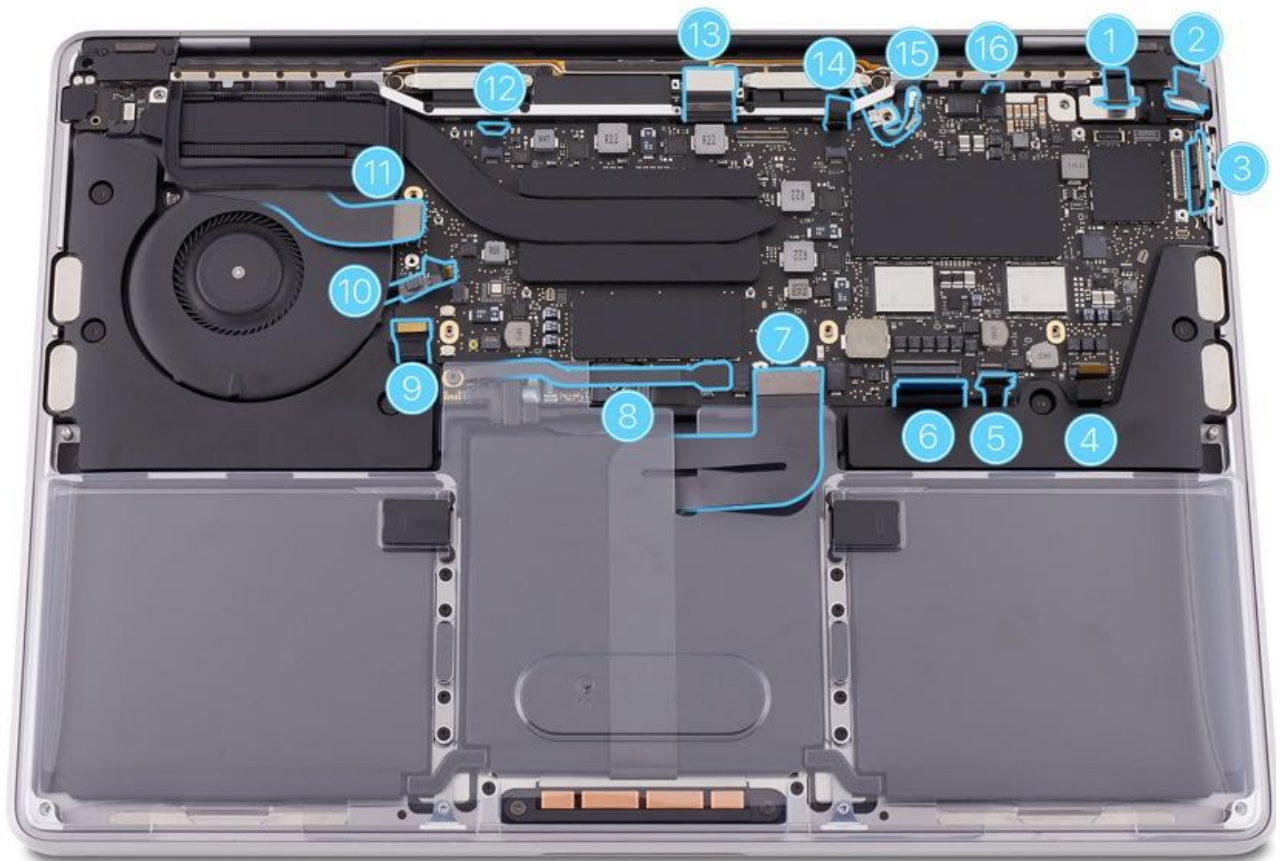
2. With the logic board still removed, identify all 15 cables in the top case.



3. Lower the top edge of the logic board into the top case. Move cables out of the way as you lower the bottom edge of the logic board into the top case.



4. Count all 16 cables to ensure none are trapped under the logic board.
Note: The eDP flex cable is attached to the logic board. The eDP flex cable isn't shown or counted in reassembly step 3.

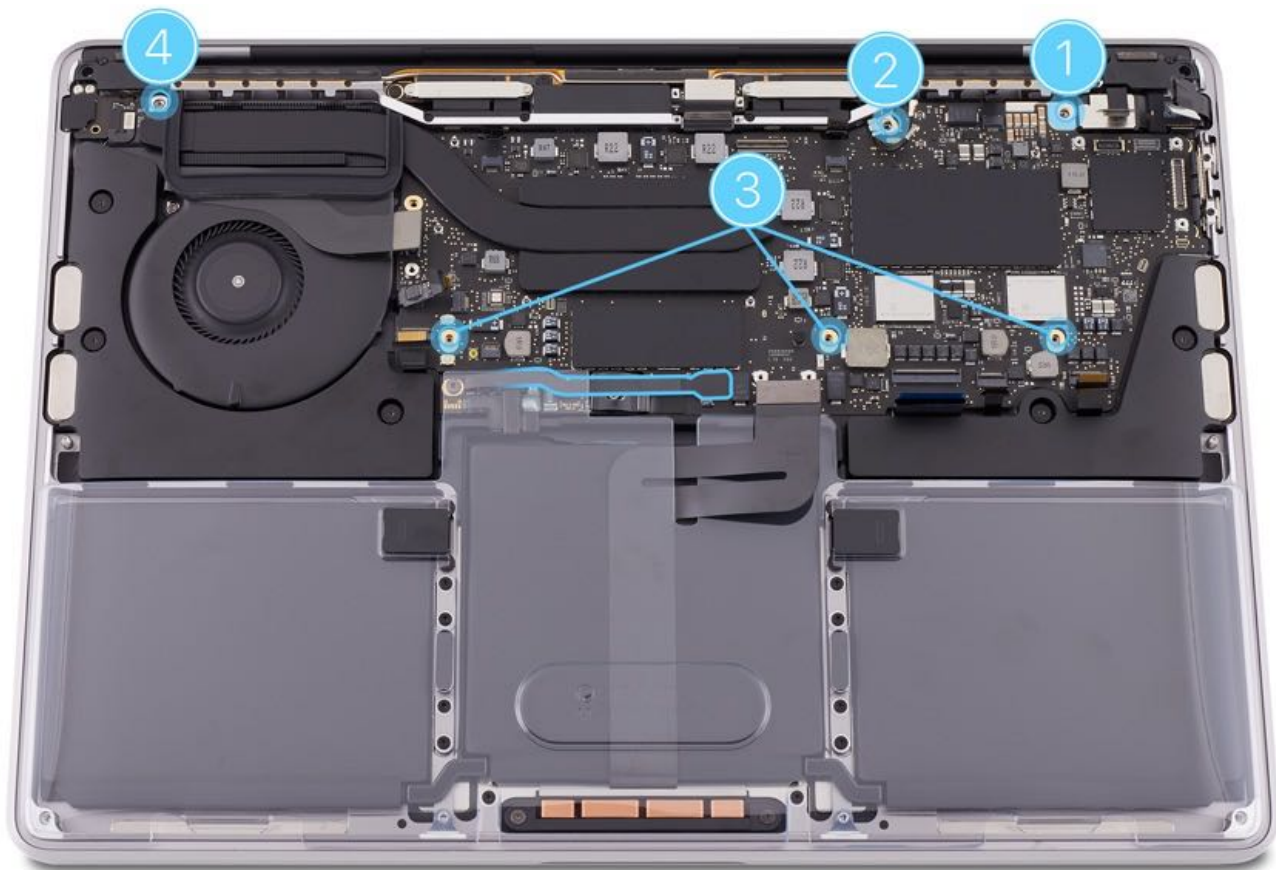


5. Partially reinstall five T5 screws in the logic board and one 3 mm hex screw in the heat sink arm. After all six screws have been partially reinstalled, fully tighten them.

(1) 923-04257 (2) 923-04256 (3) 923-04255 (4) 923-03290



One T5 screw. One T5 screw. Three T5 screws. One 3 mm hex screw.

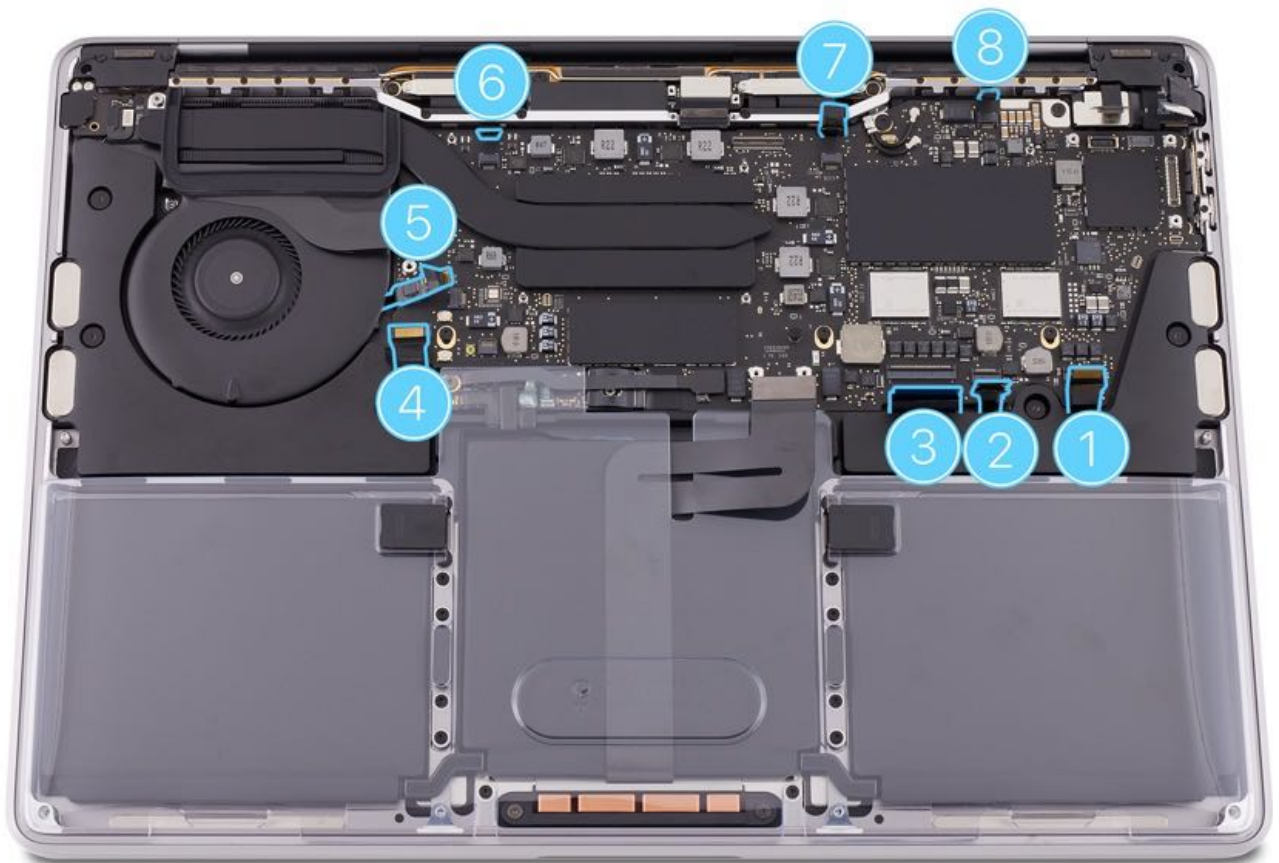


6. Use the other end of the antenna tool to reconnect the two wireless antenna cables to the logic board.
7. **Caution:** To prevent damage caused by loose debris, install a new Mylar cover (923-04328) over the wireless antennas and screw. The Mylar cover is included with service parts, but can also be ordered separately.

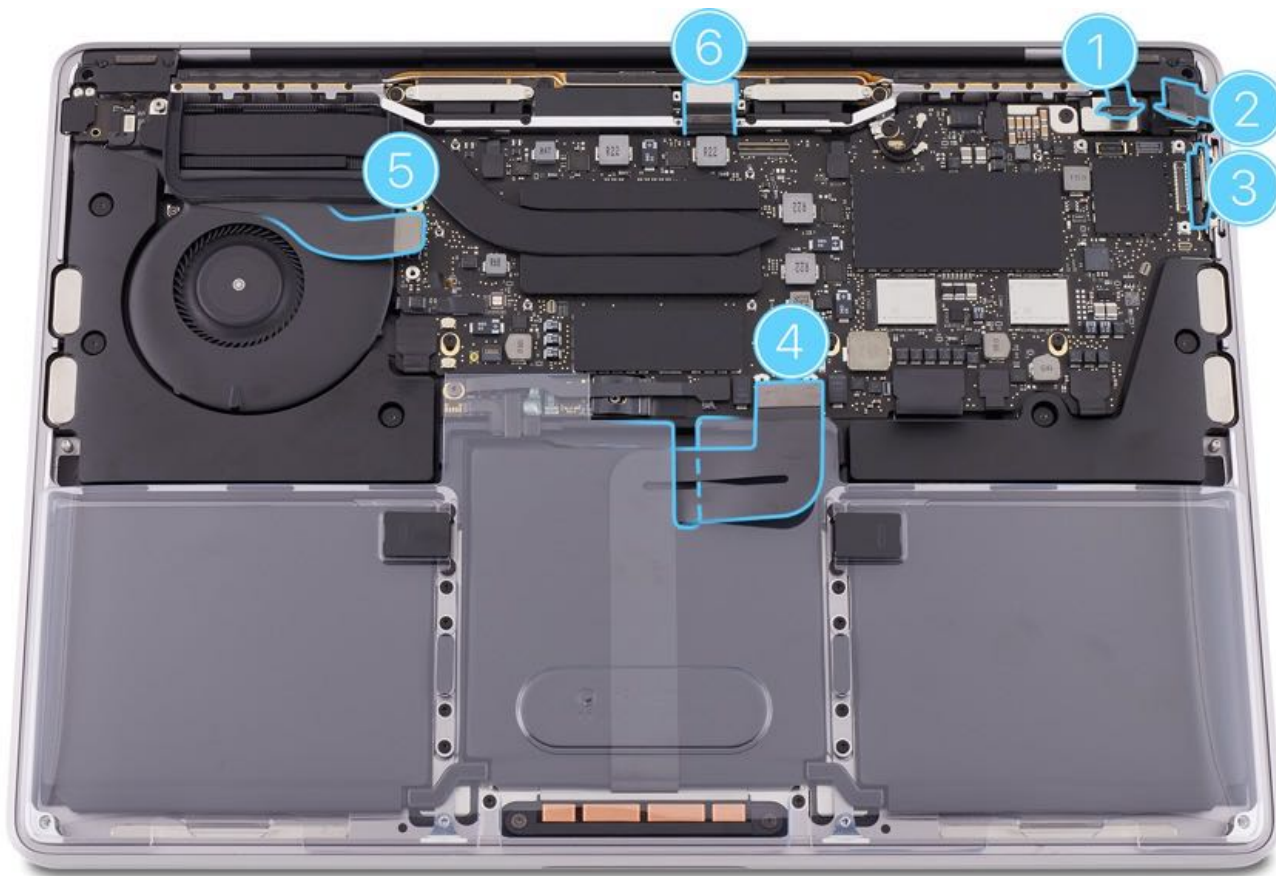


8. Reconnect the eight flex cables to the locking lever connectors on the logic board. Use a black stick to close the locking levers and readhere the flex cable pull tabs over each connector.
 1. Left speaker
 2. Keyboard backlight (power)
 3. Keyboard

4. Right speaker
5. Fan
6. Keyboard backlight (right)
7. Keyboard backlight (left)
8. Microphone



9. Reconnect five platform connector cables to the logic board and one to the TCON board.
Important: Slightly lift the battery cover and remove the trackpad cable from the slot in the battery cover. Ensure that the battery cover is fully reinstalled before continuing.
 1. Touch Bar touch
 2. Touch Bar display
 3. I/O board
 4. Trackpad
 5. Audio board flex assembly
 6. eDP



10. Reinstall six cowlings, then reinstall the 13 cowling screws.

Important: Reinstall the audio board flex assembly cowling (3) with the deeper bend positioned in the upper screw hole, closest to the heat sink arm.

1. **923-04173:** L-shaped cowling
2. **923-03215:** Trackpad flex cable cowling
3. **923-03212:** Audio board flex assembly cowling
4. **923-03214:** Touch ID board cowling
5. **923-01310:** eDP connector cowling
6. **923-04172:** eDP flex cable cowling

(1) 923-02513 (2) 923-03289 (3) 923-03526 (3) 923-03527
Upper screw hole. Lower screw hole.

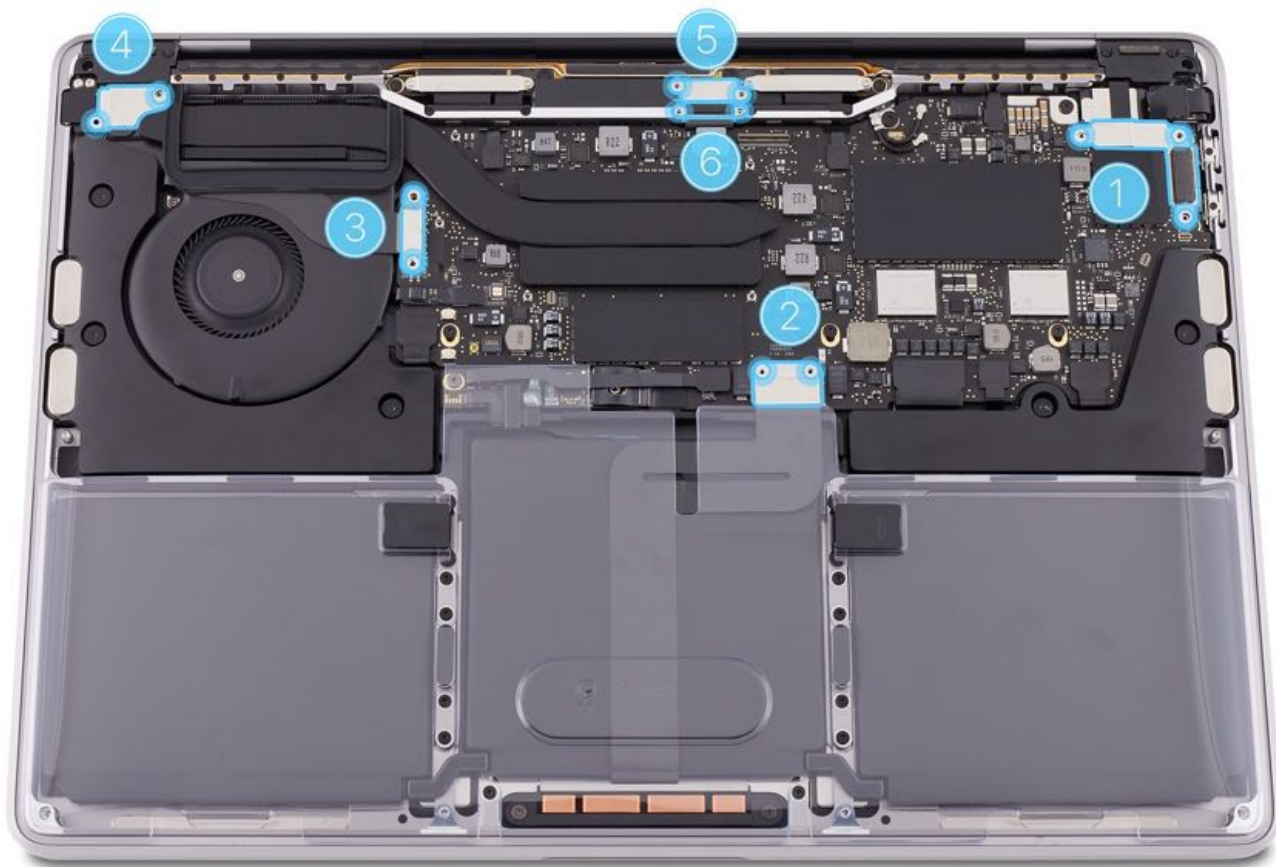


Three T3 screws. Two T5 screws. One T5 screw. One T5 screw.

(4) 923-02513 (4) 923-03554 (5) 923-04193 (6) 923-03286
Upper screw hole. Lower screw hole.



One T3 screw. One T3 screw. Two T3 screws. Two T3 screws.



11. [Reconnect the battery and remove the battery cover.](#)
12. Reinstall the [bottom case](#).

Repair Completion:

13. Run the [System Configuration Suite](#) . **Caution:** If you don't run the System Configuration Suite after you replace a [logic board](#), [Touch ID board](#), [display](#), or [top case](#), the computer will be unresponsive.
14. Run the [Trackpad Calibration Check](#) .

Post Repair Verification:

15. Run the [required AST 2 diagnostics for the parts that you replaced](#) .

Reinstalling Software That Came with the Computer

Reinstalling Software That Came with the Computer

This procedure requires an Internet connection.

Note: In some situations, a user may have set a firmware password. The user must know the firmware password in order to reinstall OS X or macOS.

Important: Apple recommends that users back up their data before any software restore procedure. Back up essential files before installing OS X or macOS. Apple is not responsible for any loss of data.

MacBook Pro (13-inch, 2020, Two Thunderbolt 3 Ports) Embedded DisplayPort (eDP) Flex Cable

First Steps



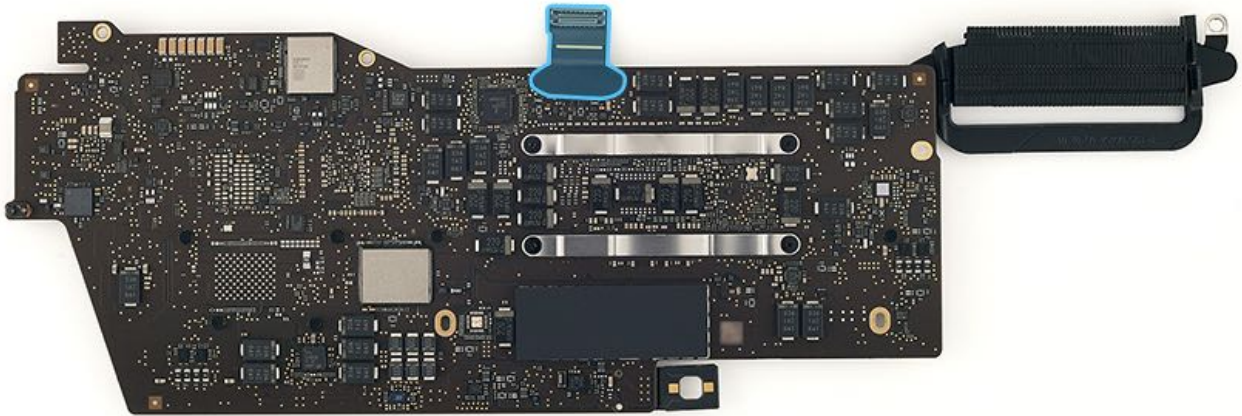
Caution:

- Only [Apple-certified technicians](#) (OP1859) should perform this procedure.
- To avoid damaging parts, ensure that you have [attached the battery cover and disconnected the battery](#) (RP1637).
- Do not apply external power while the computer is under repair.
- Wear an ESD wrist strap and take precautions to avoid ESD.

Note: Some of the images may be of a different MacBook Pro model, however the procedure is the same for MacBook Pro (13-inch, 2020, Two Thunderbolt 3 Ports).

Remove:

- [Bottom Case](#)
- [Attach the Battery Cover and Disconnect the Battery](#)
- [Logic Board](#)



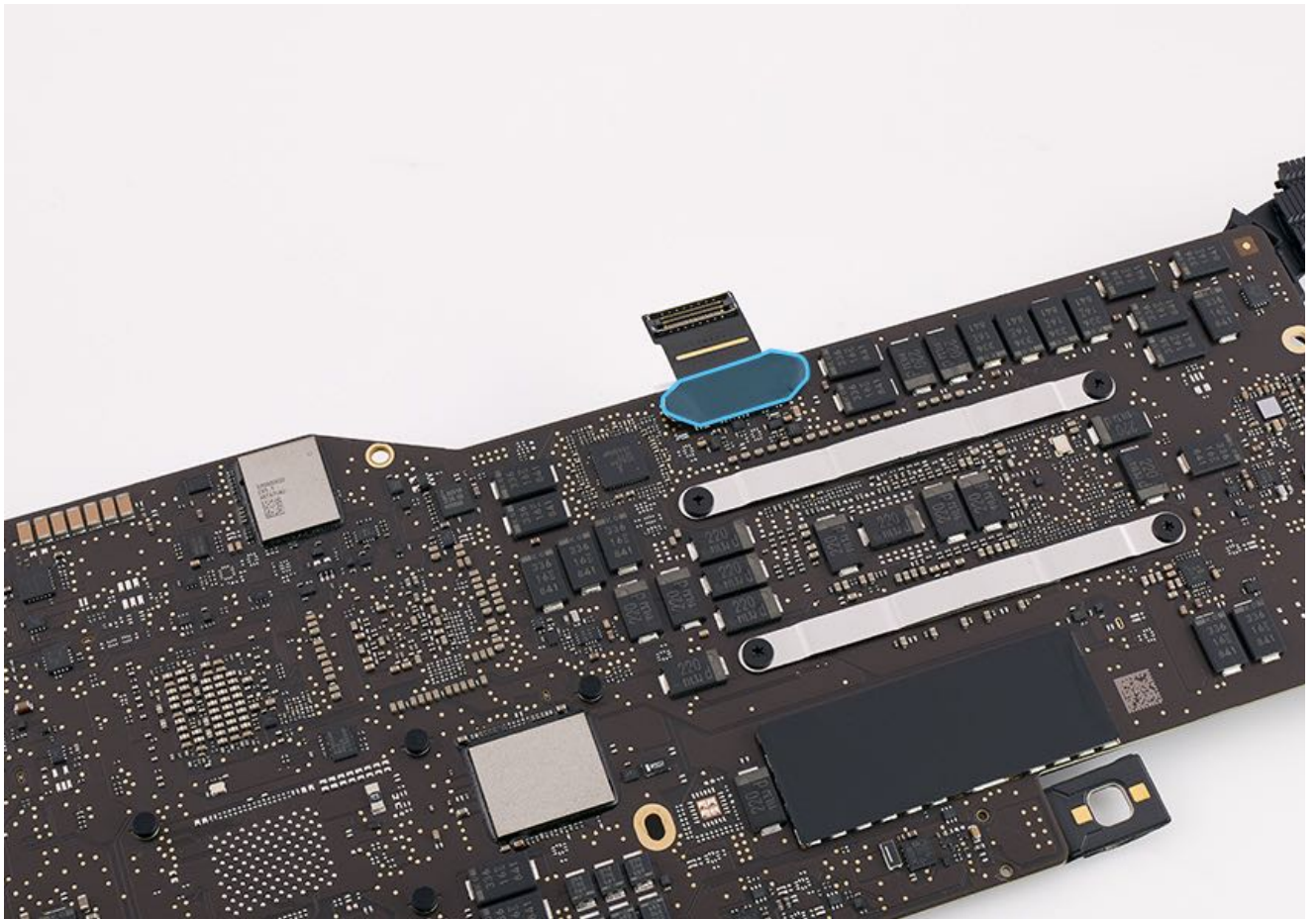
Tools

1. Torx T3 screwdriver
2. Black stick
3. ESD-safe tweezers

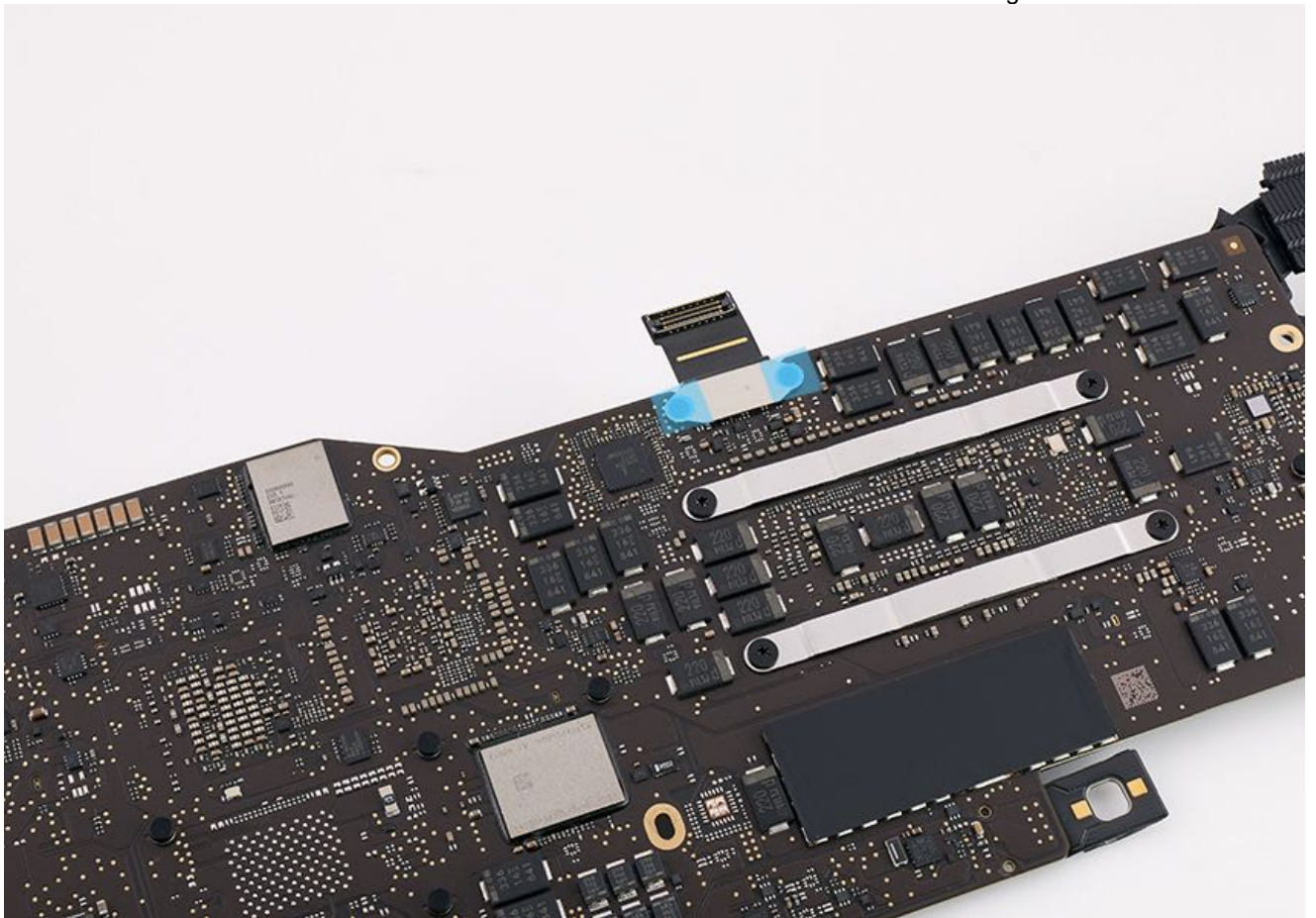


Steps For Removal

1. Peel back the Mylar tape on the right and left sides of the eDP cable to access two T3 screws.

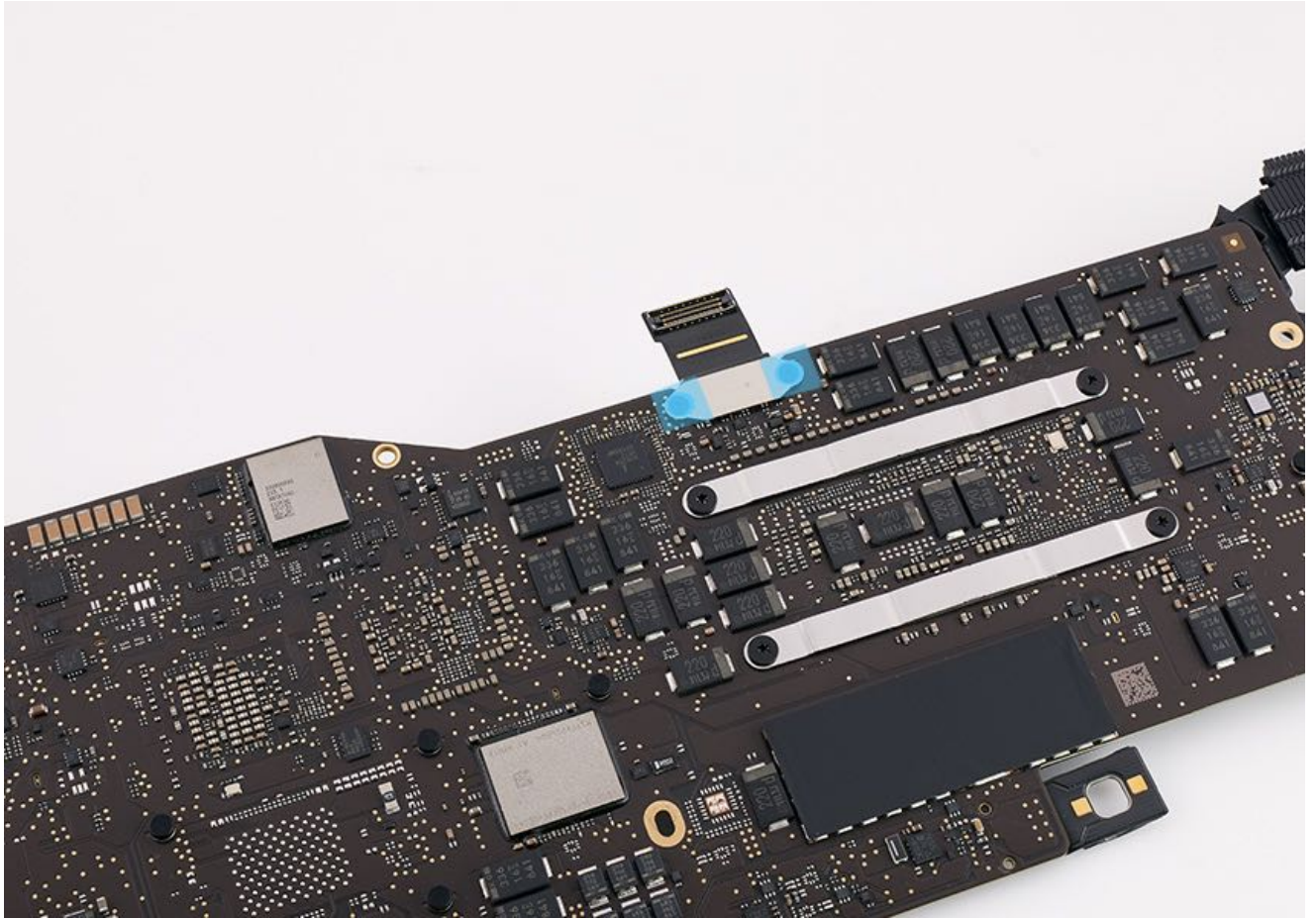


2. Remove two T3 screws. Use the flat end of a black stick to remove the eDP cable from the logic board.

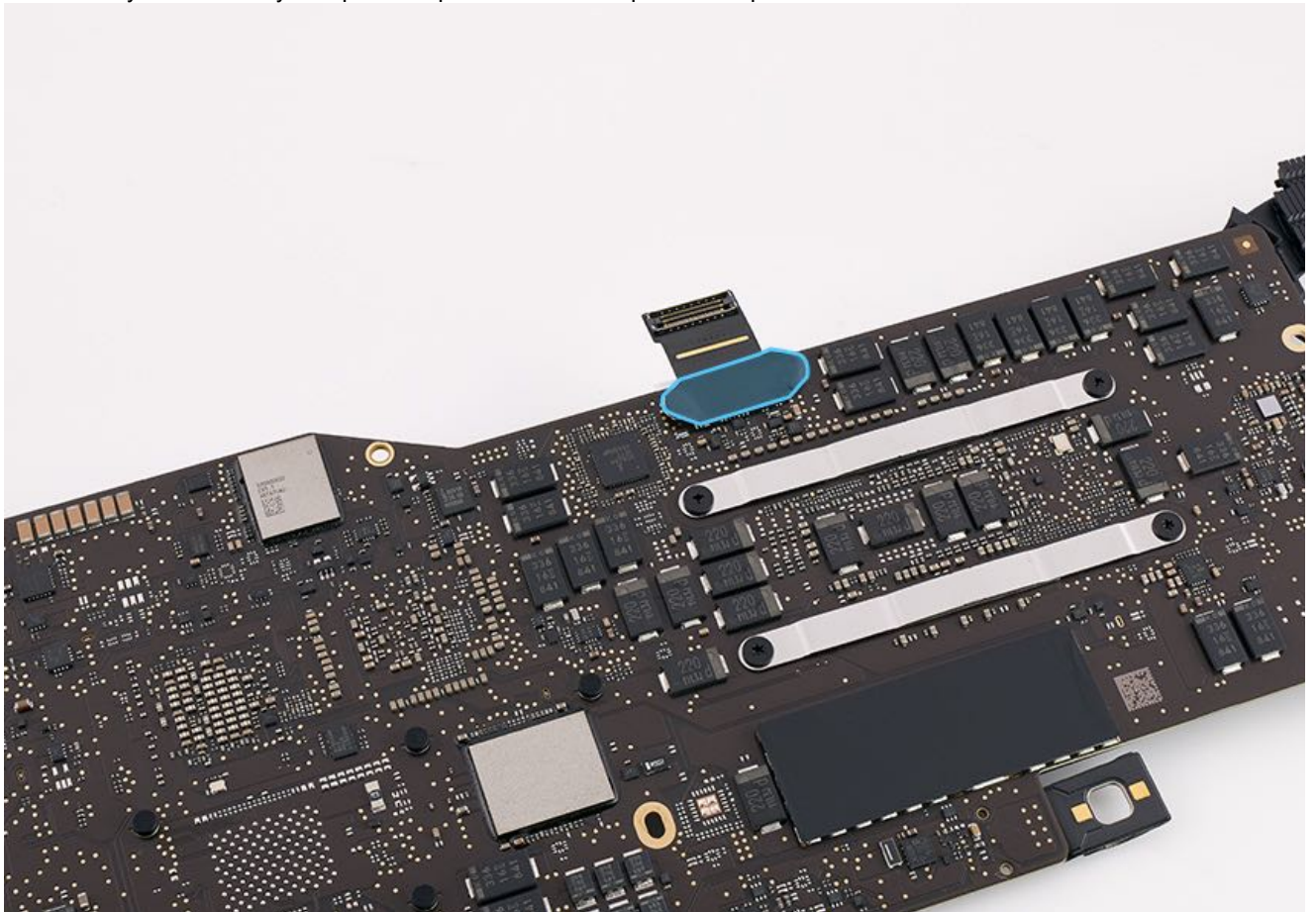


Steps For Reassembly

1. Reinstall the two T3 screws (923-01190) to the eDP flex cable cowling.



2. Fasten the Mylar tape over the eDP cable.
Note: Always use new Mylar tape if it is provided with a replacement part.



3. Reinstall the [logic board](#).

4. [Reconnect the battery and remove the battery cover](#).
5. Reinstall the [bottom case](#).

Repair Completion:

6. [System Configuration](#) must be performed after a [logic board](#), [Touch ID board](#), [display](#), and [top case](#) repair.
7. Perform the [Trackpad Calibration Check](#) to verify trackpad performance after every repair.

Post Repair Verification:

8. After repair completion, verify the repair was successful by running the [required AST 2 diagnostics based on the repair module that was replaced](#).

MacBook Pro (13-inch, 2020, Two Thunderbolt 3 Ports) Heat Sink

First Steps



Caution:

- Only [Apple-certified technicians](#) should perform this procedure.
- To avoid damaging parts, ensure that you have [attached the battery cover and disconnected the battery](#).
- Do not apply external power while the computer is under repair.
- Wear an ESD wrist strap and take precautions to avoid ESD.

Important:

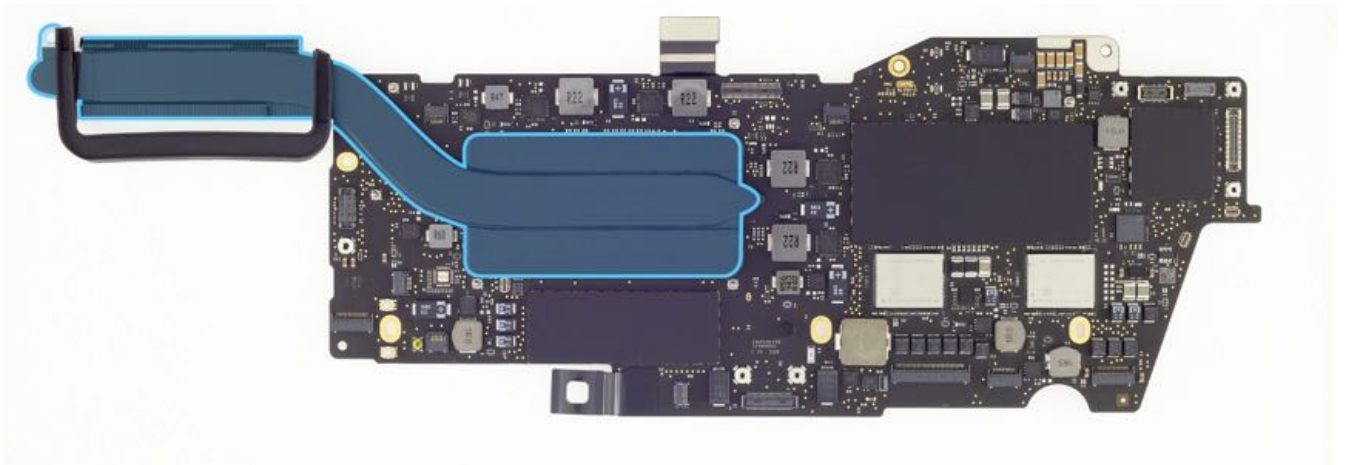
- Don't remove the heat sink unless you are replacing **only** the heat sink. A replacement logic board comes with the heat sink installed.

Note:

- Some of the images may be of a different MacBook Pro model, however the procedure is the same for MacBook Pro (13-inch, 2020, Two Thunderbolt 3 Ports).

Remove:

- [Bottom Case](#)
- [Attach the Battery Cover and Disconnect the Battery](#)
- [Logic Board](#)



Tools

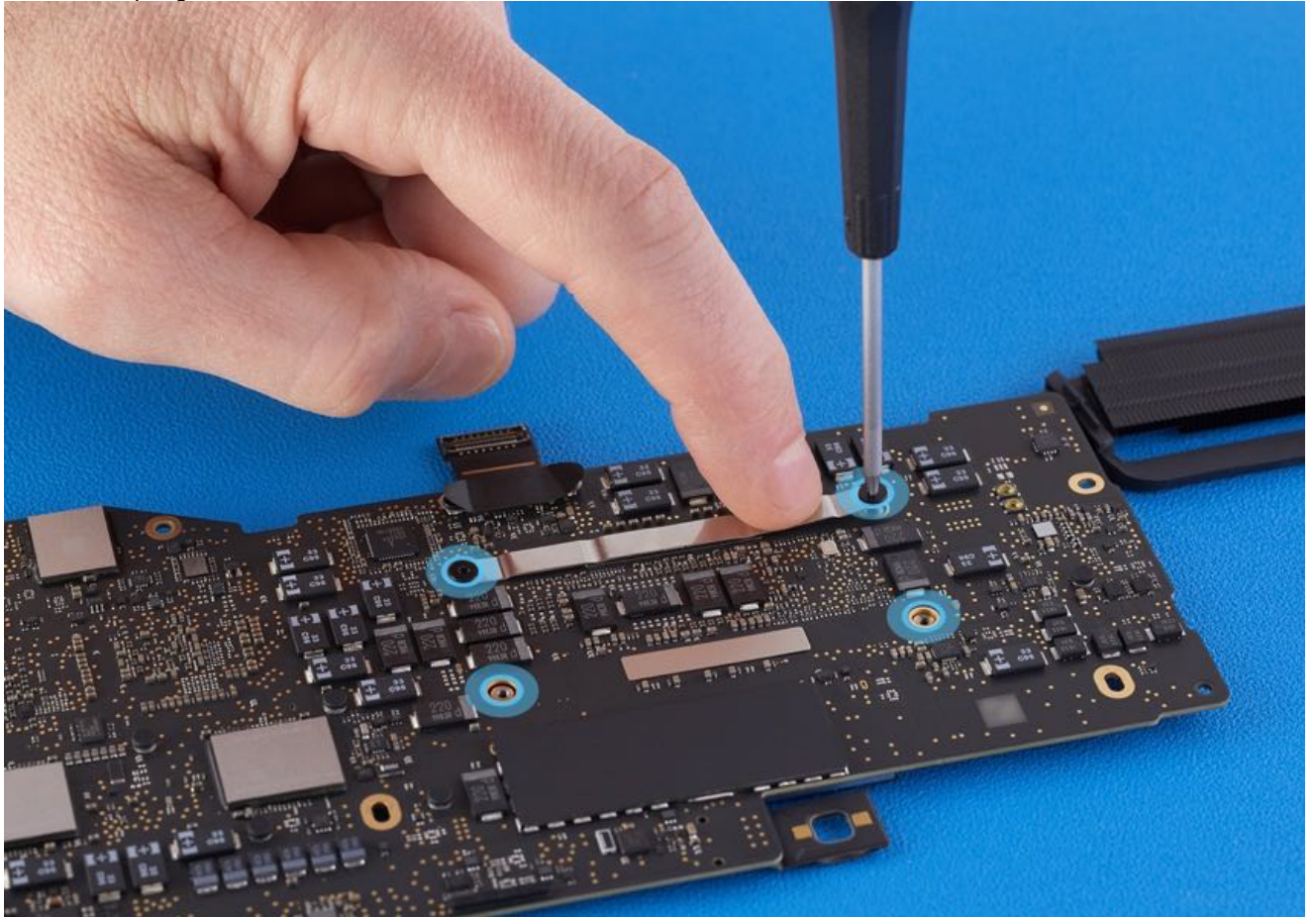
1. Thermal grease syringe (922-7144)
2. Torx T5 screwdriver
3. ESD-safe tweezers
4. Isopropyl alcohol (IPA) wipes



Steps For Removal

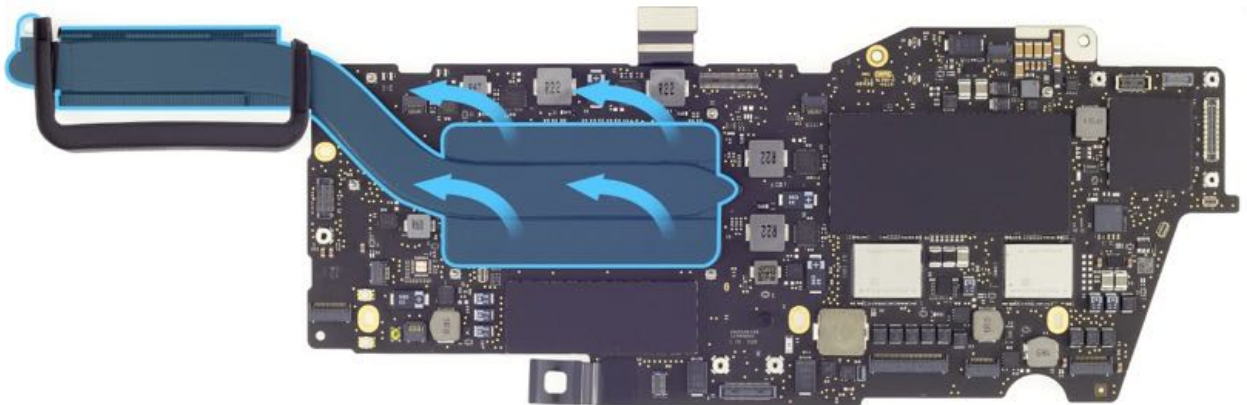
1. Turn the logic board over. Place the logic board on an ESD mat. Remove four T5 screws from the heat sink CPU springs.

Important: The CPU springs are under tension. Gently hold down the CPU springs when removing the first screw from each CPU spring.



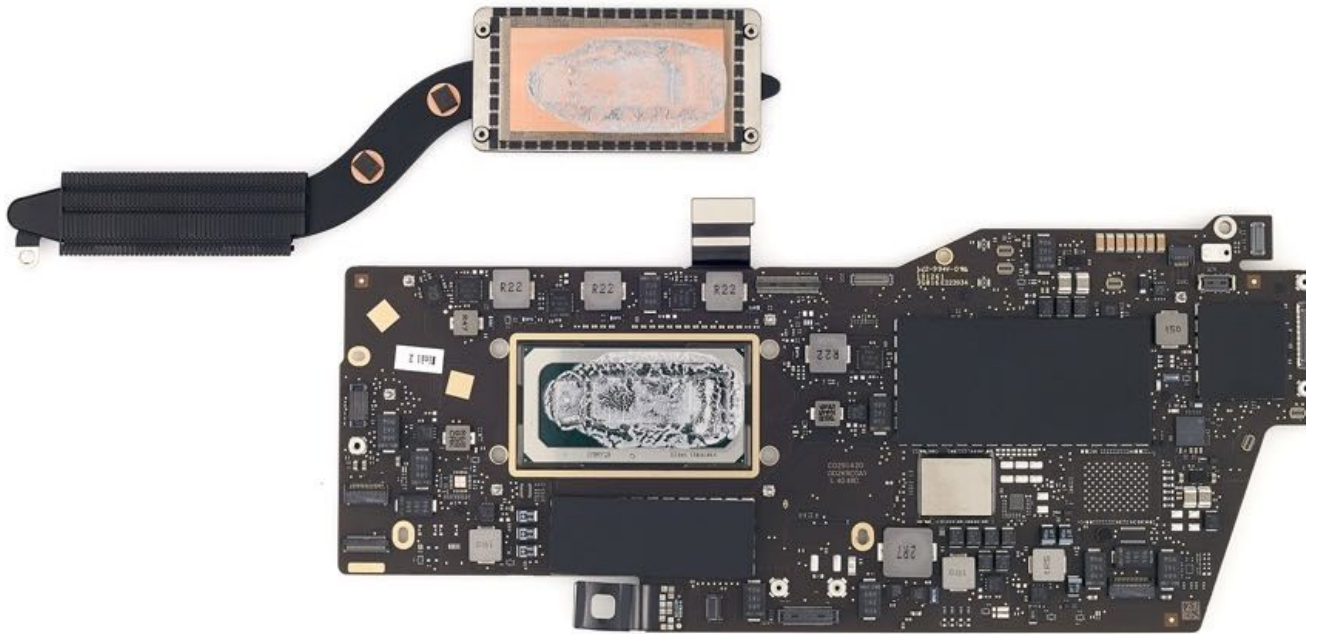
2. The heat sink should release from the logic board once the screws are removed. If the heat sink doesn't release, turn the logic board over and gently wiggle the corners of the heat sink to loosen the thermal bond.

Important: Always hold the heat sink by the body, never by the heat sink arm.

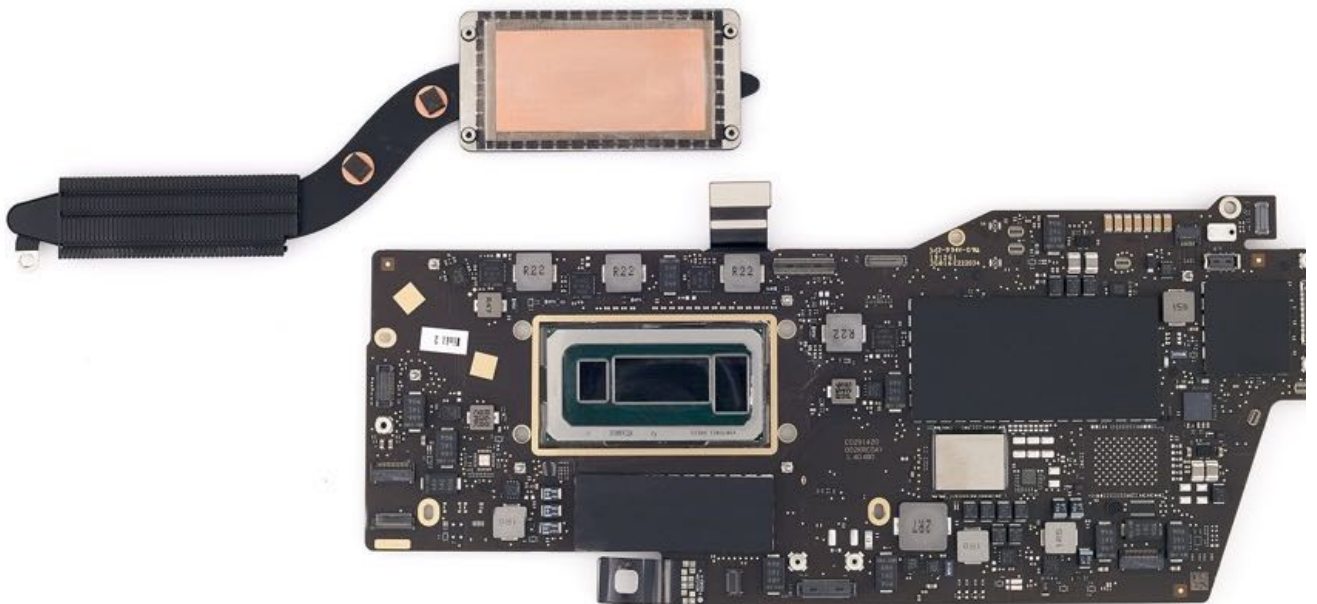


3. Use IPA wipes to clean the thermal grease from the heat sink and the processors on the logic board.

Before cleaning

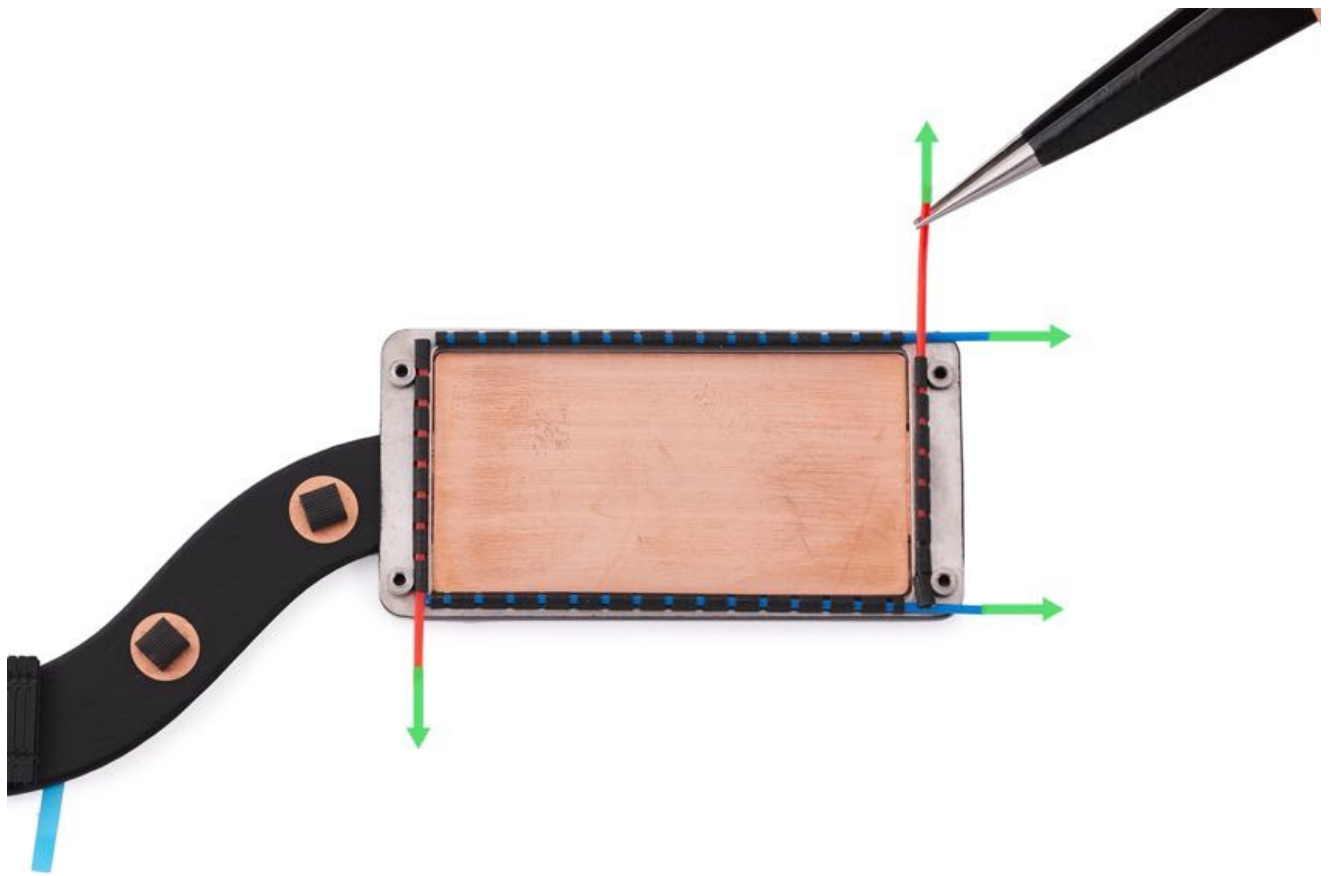


After cleaning

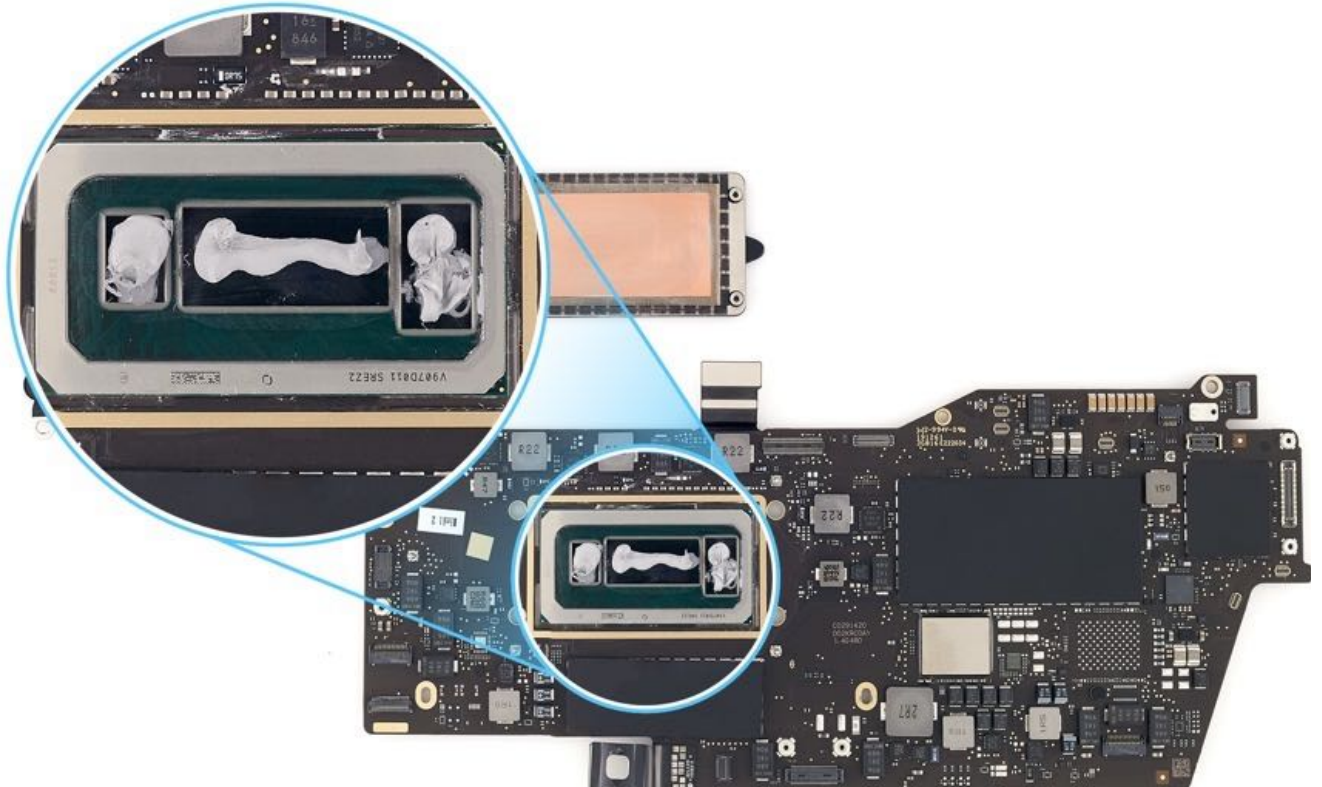


Steps For Reassembly

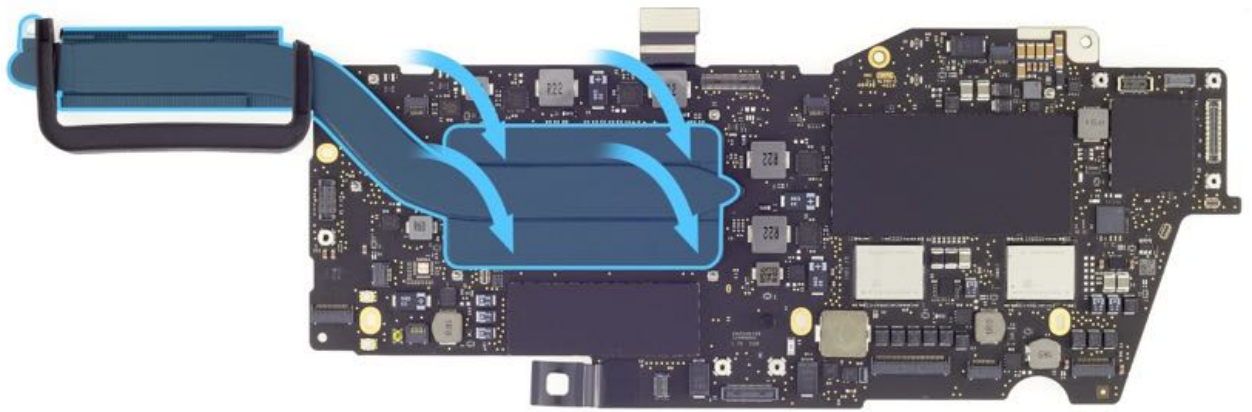
1. If you are installing a replacement heat sink, use tweezers to carefully pull out the four tubes from the air loop strips.



2. Inject a line of thermal grease across the processors on the logic board.

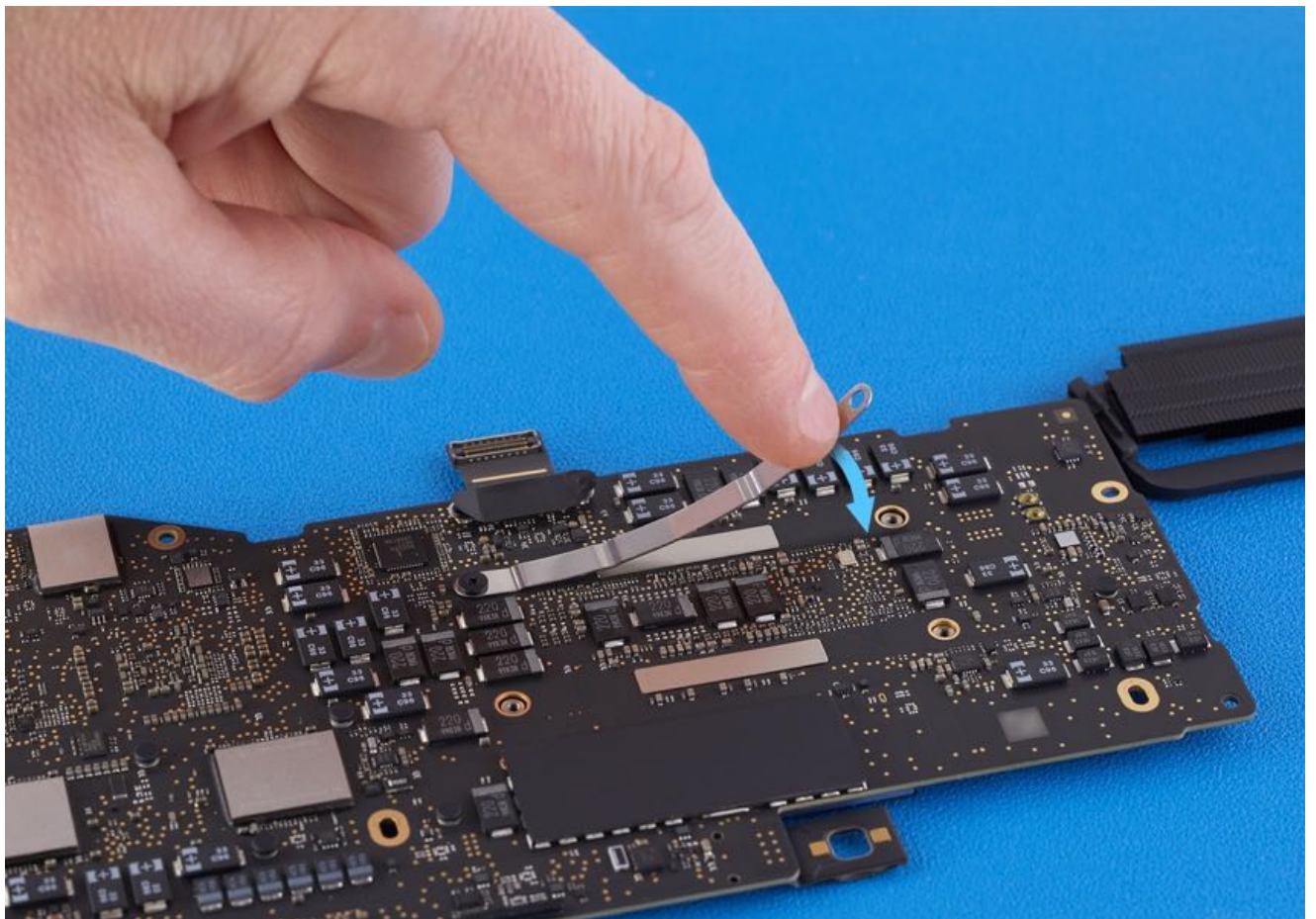


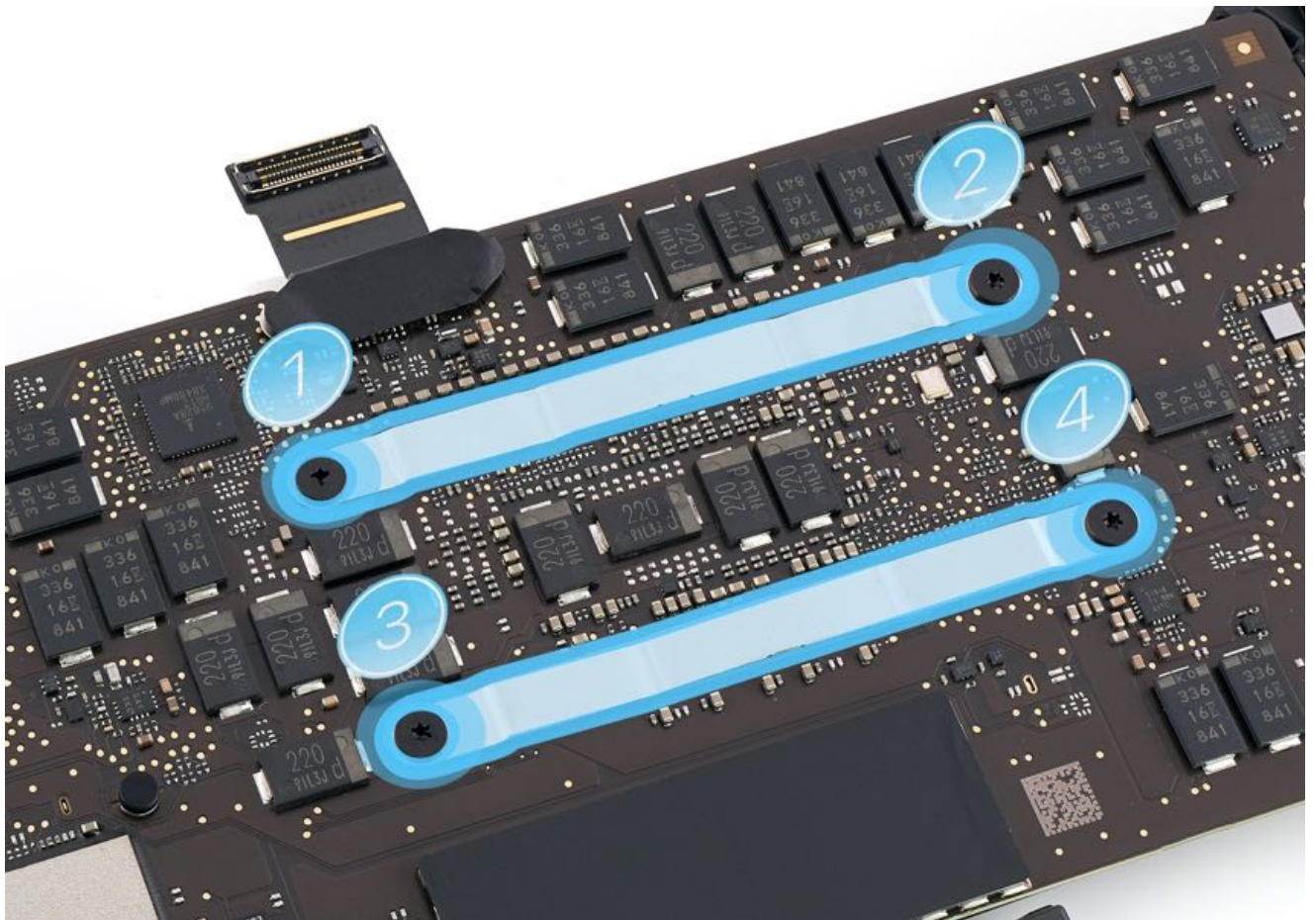
3. Carefully align the heat sink screw bosses with the screw holes in the logic board. Hold the heat sink in place as you carefully turn over the logic board to reinstall the screws.



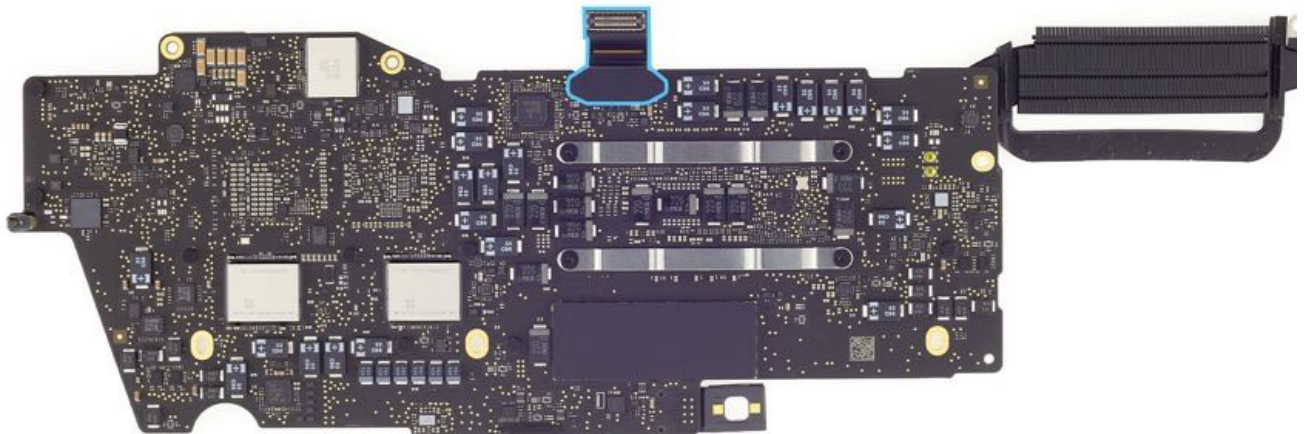
4. Reinstall the two CPU springs and four T5 screws (923-01407) in the order shown.

Note: The CPU springs are under tension. Press down on the CPU spring when reinstalling the second screw.

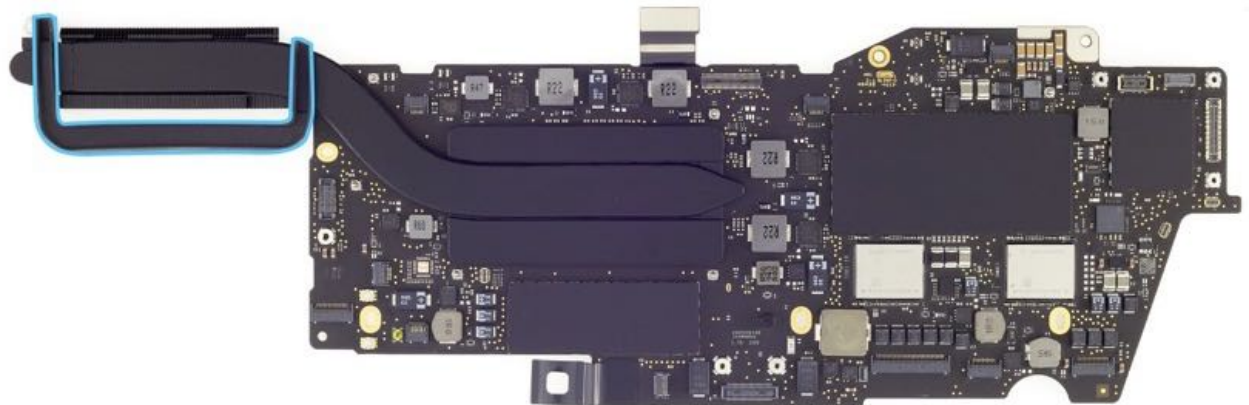




5. Check that the eDP flex cable is attached to the logic board.



6. Ensure the thermal duct is installed.



7. Reinstall the [logic board](#) into the top case.
8. [Reconnect the battery and remove the battery cover](#).
9. Reinstall the [bottom case](#).

Repair Completion:

10. [System Configuration](#) must be performed after a [logic board](#), [Touch ID board](#), [display](#), and [top case](#) repair.
11. Perform the [Trackpad Calibration Check](#) to verify trackpad performance after every repair.

Post Repair Verification:

12. After repair completion, verify the repair was successful by running the [required AST 2 diagnostics based on the repair module that was replaced](#) .

MacBook Pro (13-inch, 2020, Two Thunderbolt 3 Ports) Input/Output (I/O) Board

First Steps



Caution:

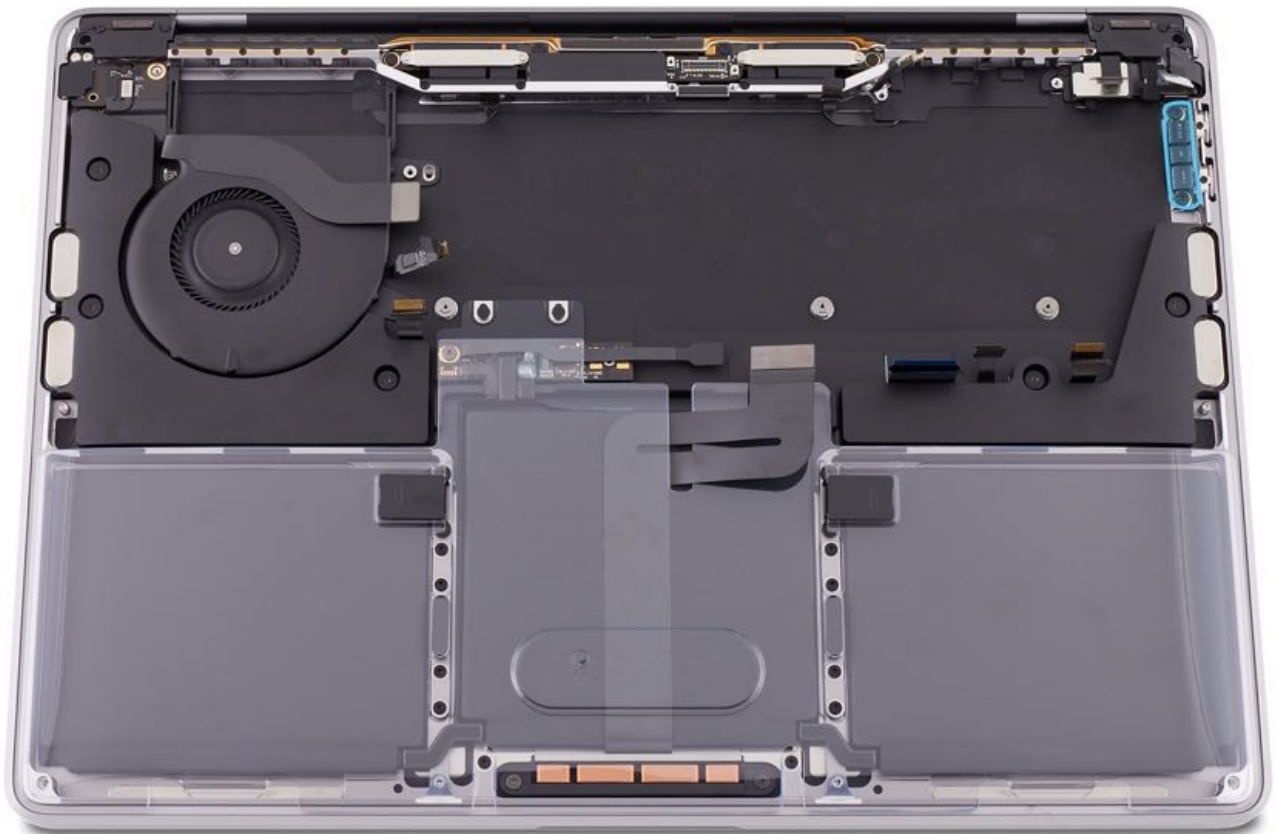
- Only [Apple-certified technicians](#) (OP1859) should perform this procedure.
- To avoid damaging parts, ensure that you have [attached the battery cover and disconnected the battery](#) (RP1637).
- Do not apply external power while the computer is under repair.
- Wear an ESD wrist strap and take precautions to avoid ESD.

Note:

- Some of the images shown may be of a different MacBook Pro model, however the procedure is the same for MacBook Pro (13-inch, 2020, Two Thunderbolt 3 Ports).

Remove:

- [Bottom Case](#)
- [Attach the Battery Cover and Disconnect the Battery](#)
- [Logic Board](#)



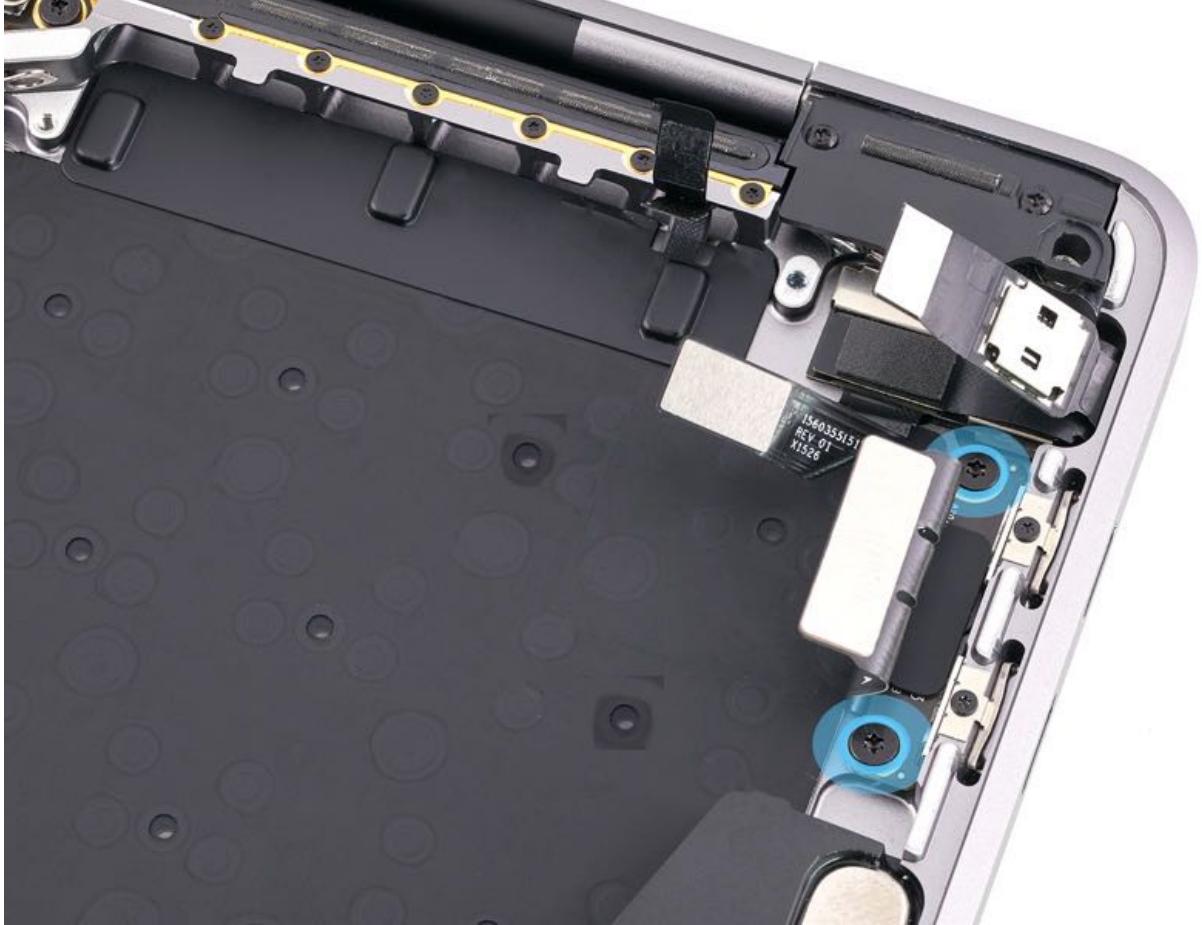
Tools

1. Torx T5 screwdriver
2. Black stick
3. USB-C charge cable

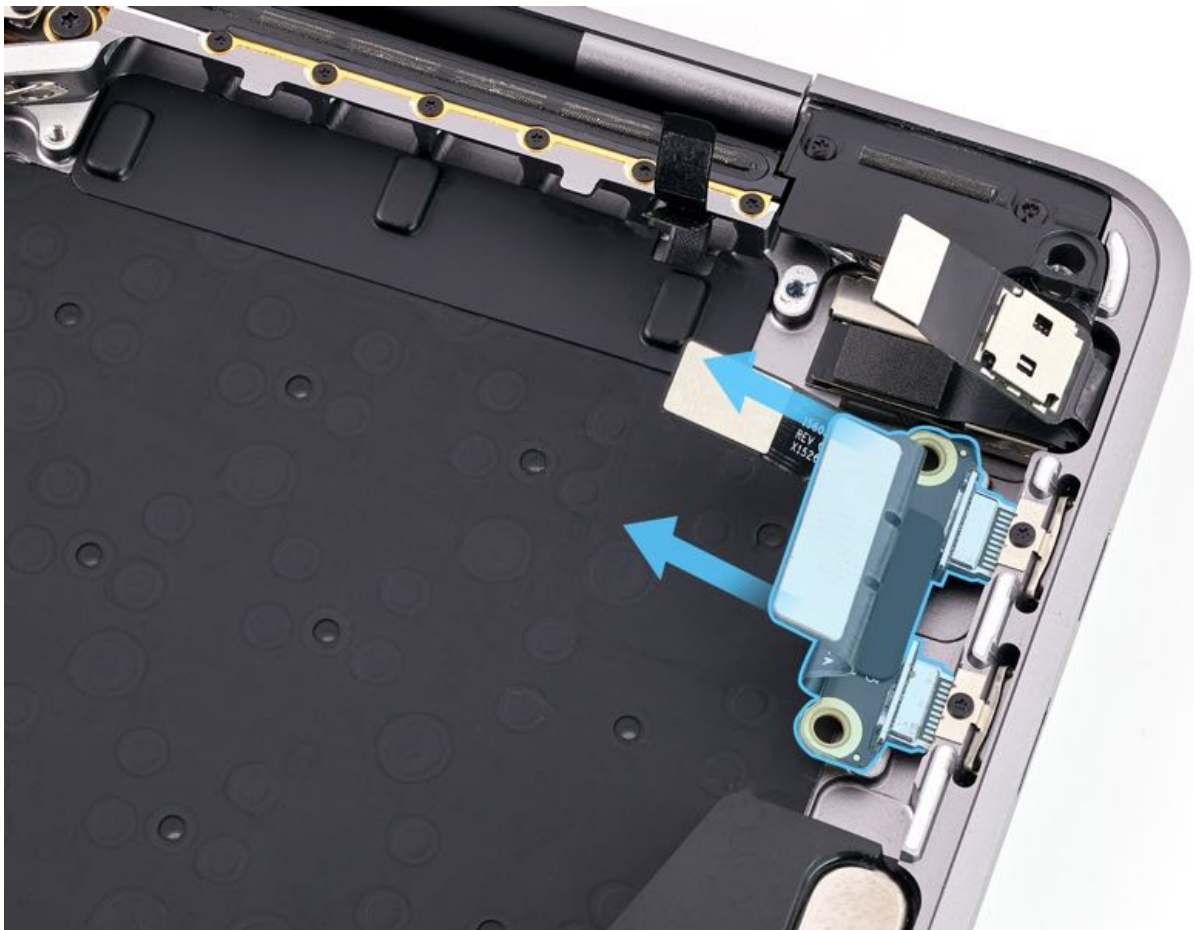


Steps For Removal

1. Remove two T5 screws for the I/O board.

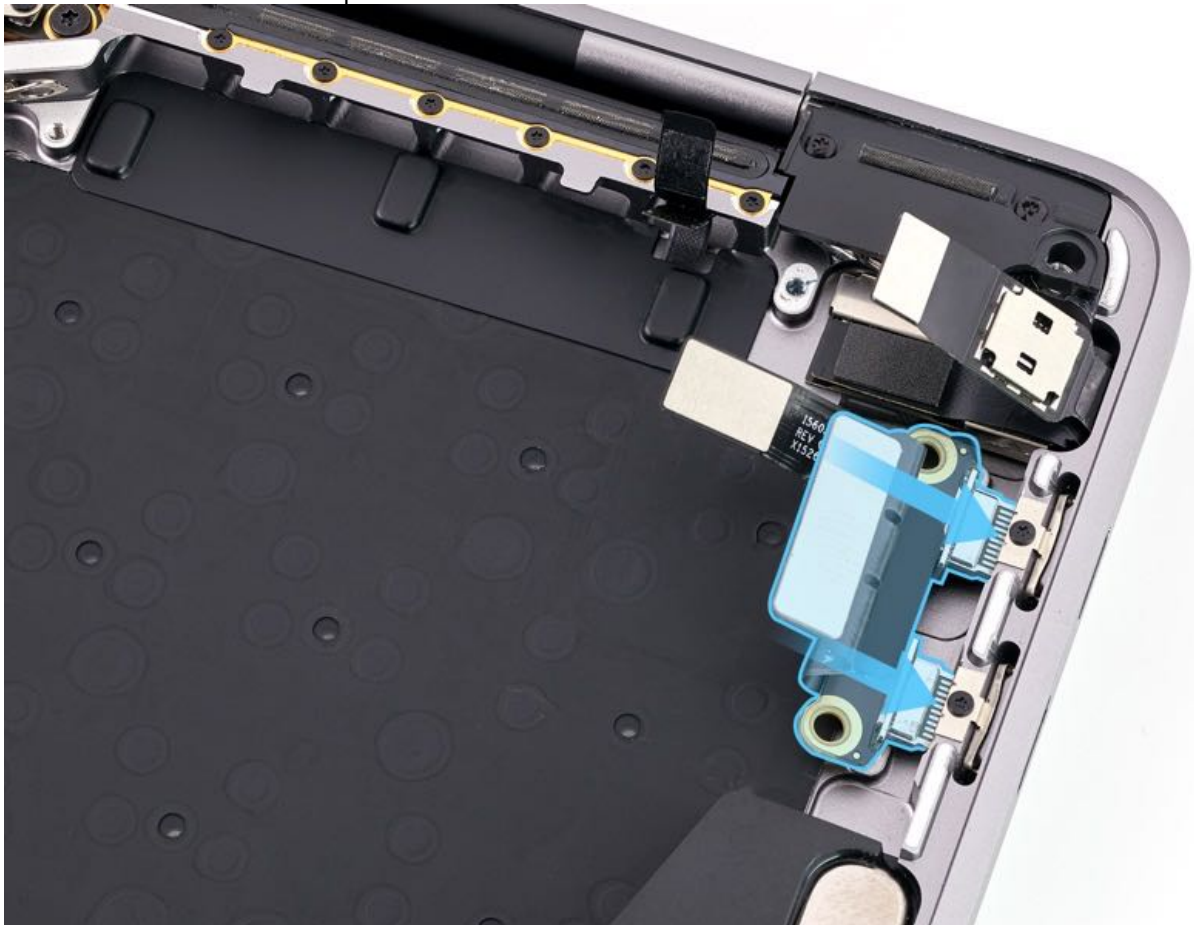


2. Gently grasp the I/O board by the sides and slide it out of the top case.



Steps For Reassembly

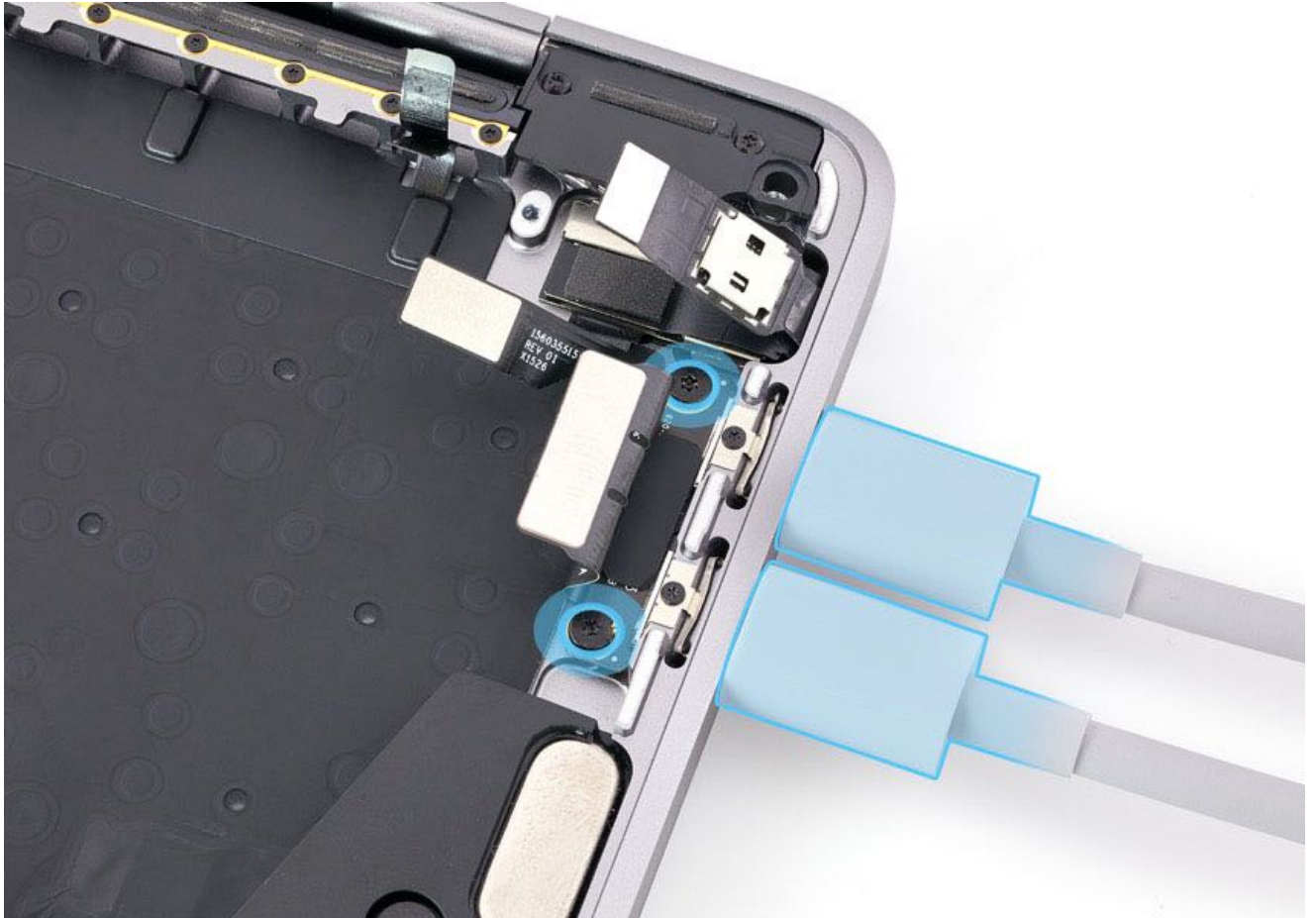
1. Reinstall the I/O board in the top case.



2. Partially reinstall the two T5 screws (923-03559). Plug both ends of an external USB-C charge cable into both ports to check alignment. Then fully tighten the two T5 screws.



Caution: The charge cable should **not** be plugged into power.



3. Reinstall the [logic board](#).
4. [Reconnect the battery and remove the battery cover](#).
5. Reinstall the [bottom case](#).

Repair Completion:

6. [System Configuration](#) must be performed after a [logic board](#), [Touch ID board](#), [display](#), and [top case](#) repair.
7. Perform the [Trackpad Calibration Check](#) to verify trackpad performance after every repair.

Post Repair Verification:

8. After repair completion, verify the repair was successful by running the [required AST 2 diagnostics based on the repair module that was replaced](#).

MacBook Pro (13-inch, 2020, Two Thunderbolt 3 Ports) Speakers

First Steps

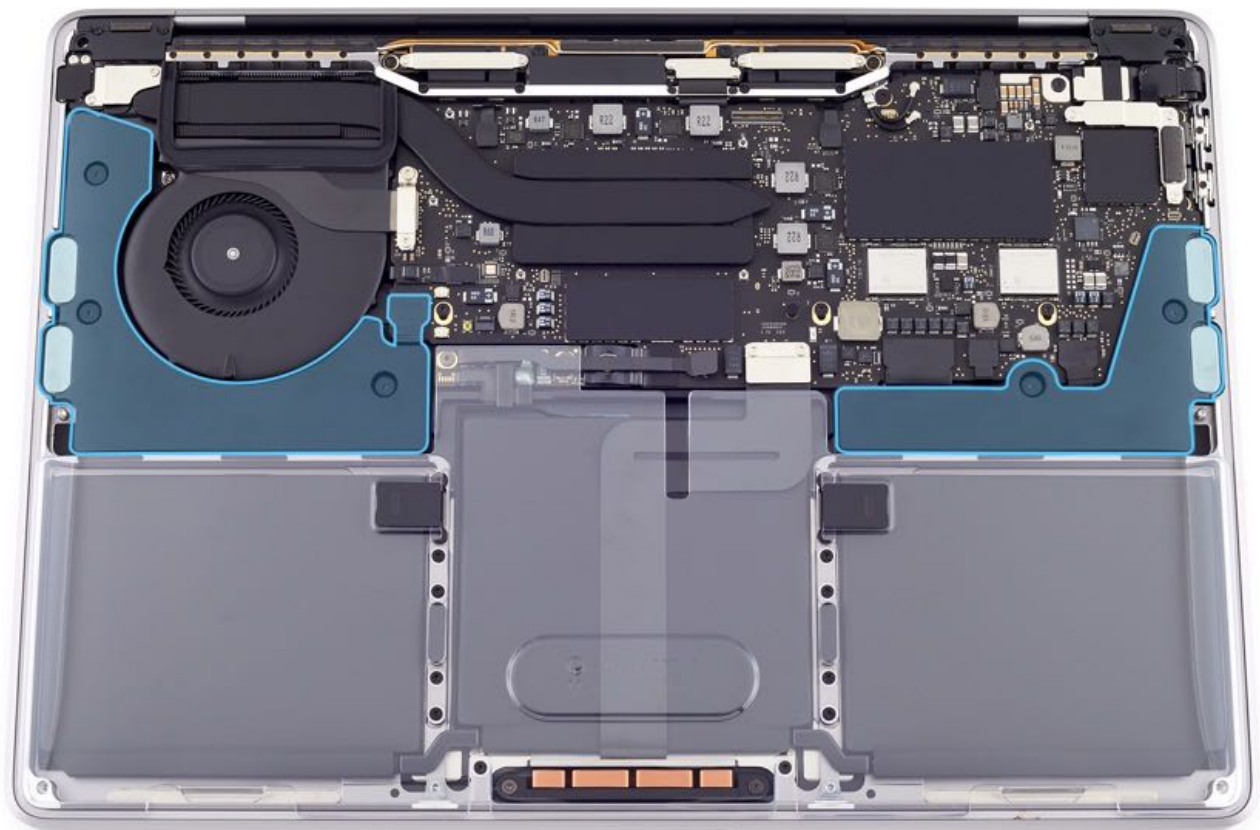


Caution:

- Only [Apple-certified technicians](#) should perform this procedure.
- To avoid damaging parts, ensure that you have [attached the battery cover and disconnected the battery](#).
- Do not apply external power while the computer is under repair.
- Wear an ESD wrist strap and take precautions to avoid ESD.

Remove:

- [Bottom Case](#)
- [Attach the Battery Cover and Disconnect the Battery](#)



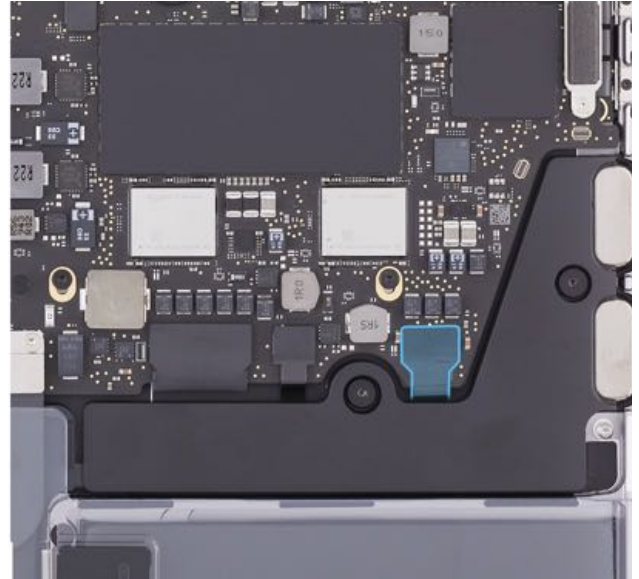
Tools

1. Torx T5 screwdriver
2. Black stick



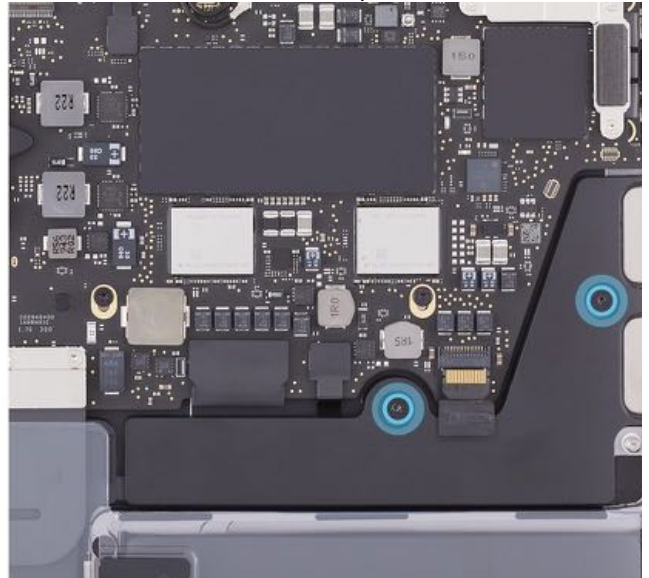
Steps For Removal

1. Gently lift the pull tabs on the speaker flex cables to reveal the locking lever connectors on the logic board. Use a black stick to flip the locking levers up, then disconnect the speaker flex cables.

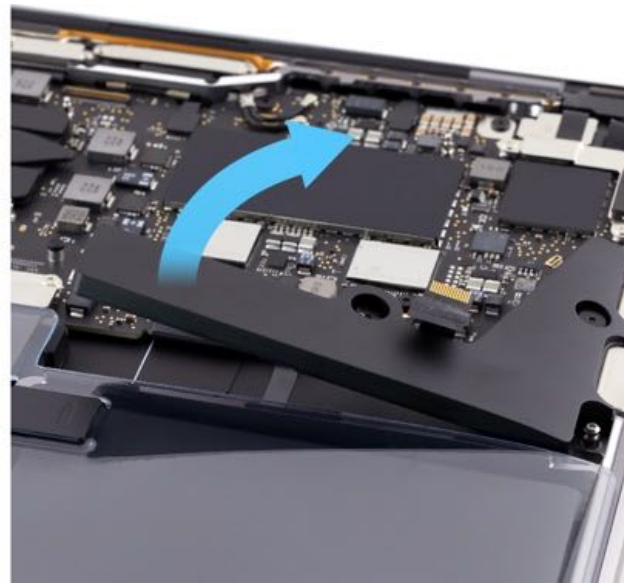


2. Remove three T5 screws from the right speaker and two T5 screws from the left speaker.

Note: The screws tighten into rubber grommets and may remain in the screw holes when the speakers are removed.

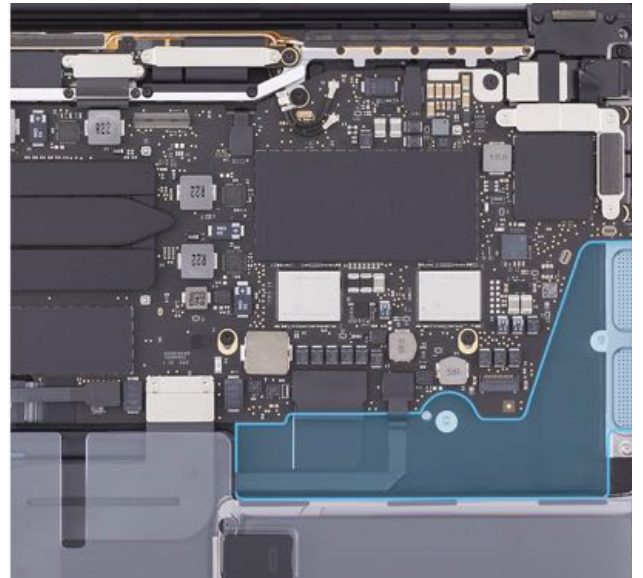
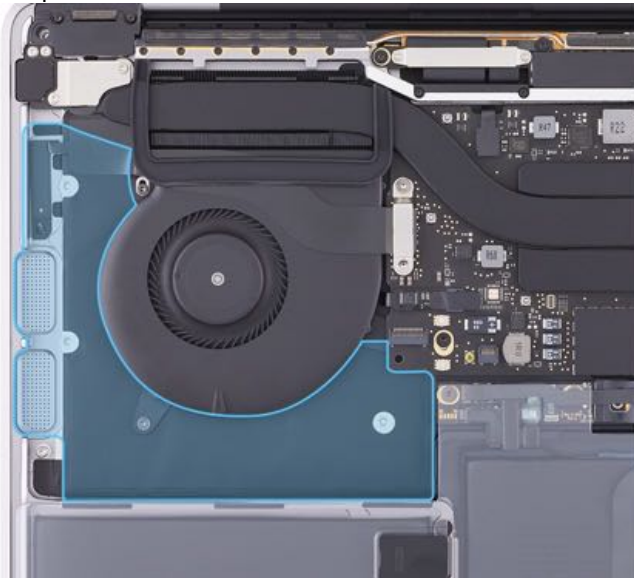


3. Lift the speakers out of the top case.



Steps For Reassembly

1. Check that the speaker areas in the top case, especially the speaker grilles, are free of any debris before reinstalling the speakers.

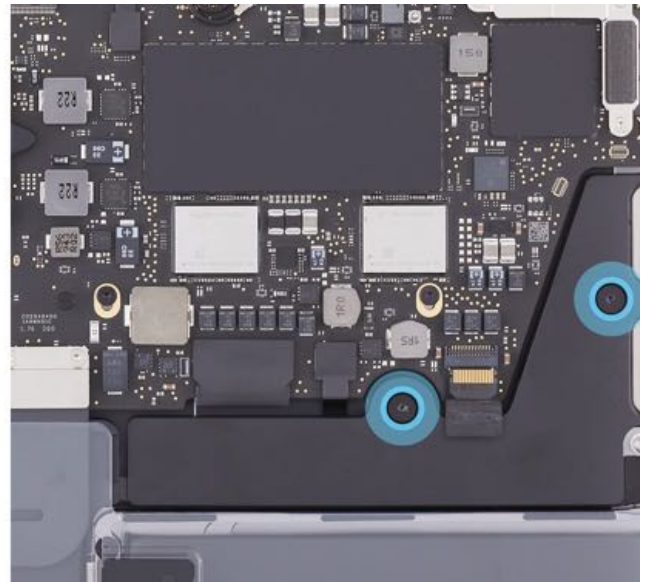
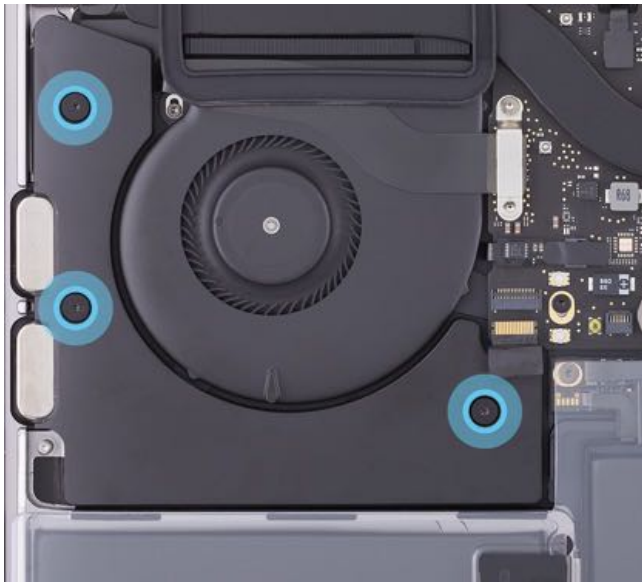


2. Reinstall the speakers at a slight angle to ensure proper alignment with the top case.

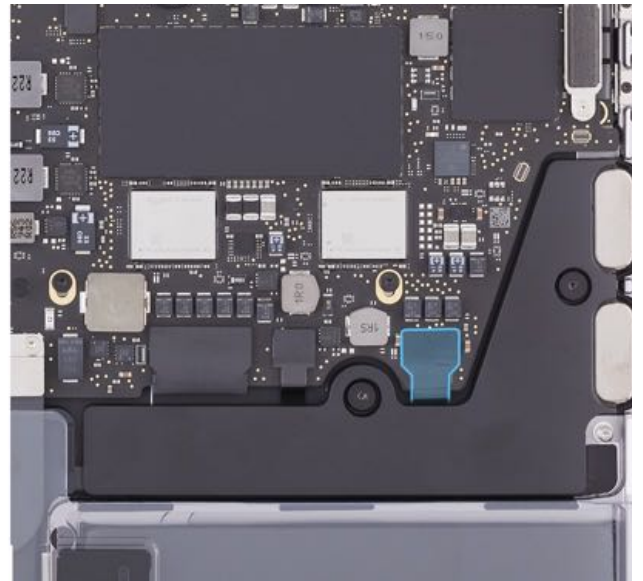


3. Reinstall five T5 screws (923-03540), three in the right speaker and two in the left speaker.





4. Reconnect the speaker flex cables to the locking lever connectors on the logic board. Use a black stick to close the locking levers, then readhere the flex cable pull tabs over the connectors.



5. Reconnect the battery and remove the battery cover.
6. Reinstall the bottom case.

Repair Completion:

7. [System Configuration](#) must be performed after a [logic board](#), [Touch ID board](#), [display](#), and [top case](#) repair.
8. Perform the [Trackpad Calibration Check](#) to verify trackpad performance after every repair.

Post Repair Verification:

9. After repair completion, verify the repair was successful by running the [required AST 2 diagnostics based on the repair module that was replaced](#).

MacBook Pro (13-inch, 2020, Two Thunderbolt 3 Ports) Clutch Covers

First Steps

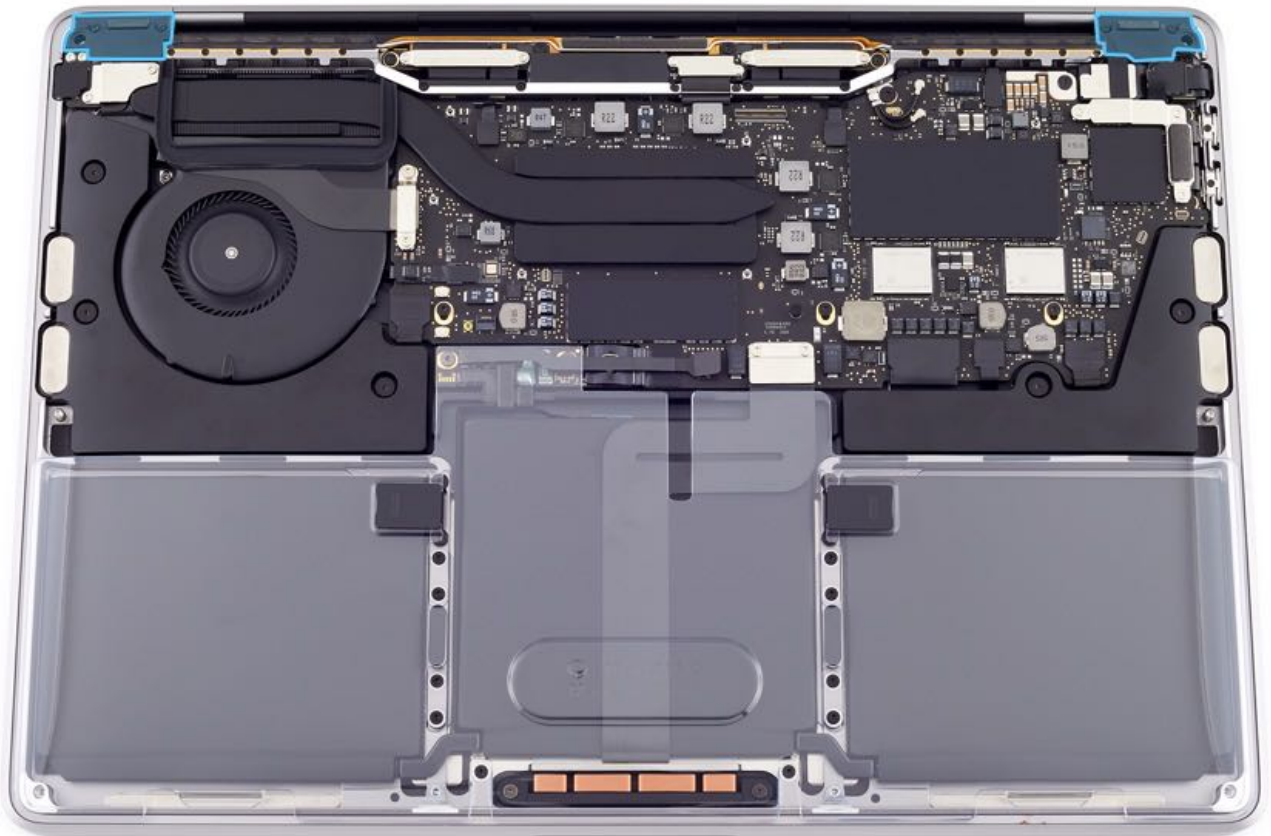


Caution:

- Only [Apple-certified technicians](#) should perform this procedure.
- To avoid damaging parts, ensure that you have [attached the battery cover and disconnected the battery](#).
- Do not apply external power while the computer is under repair.
- Wear an ESD wrist strap and take precautions to avoid ESD.

Remove:

- [Bottom Case](#)
- [Attach the Battery Cover and Disconnect the Battery](#)



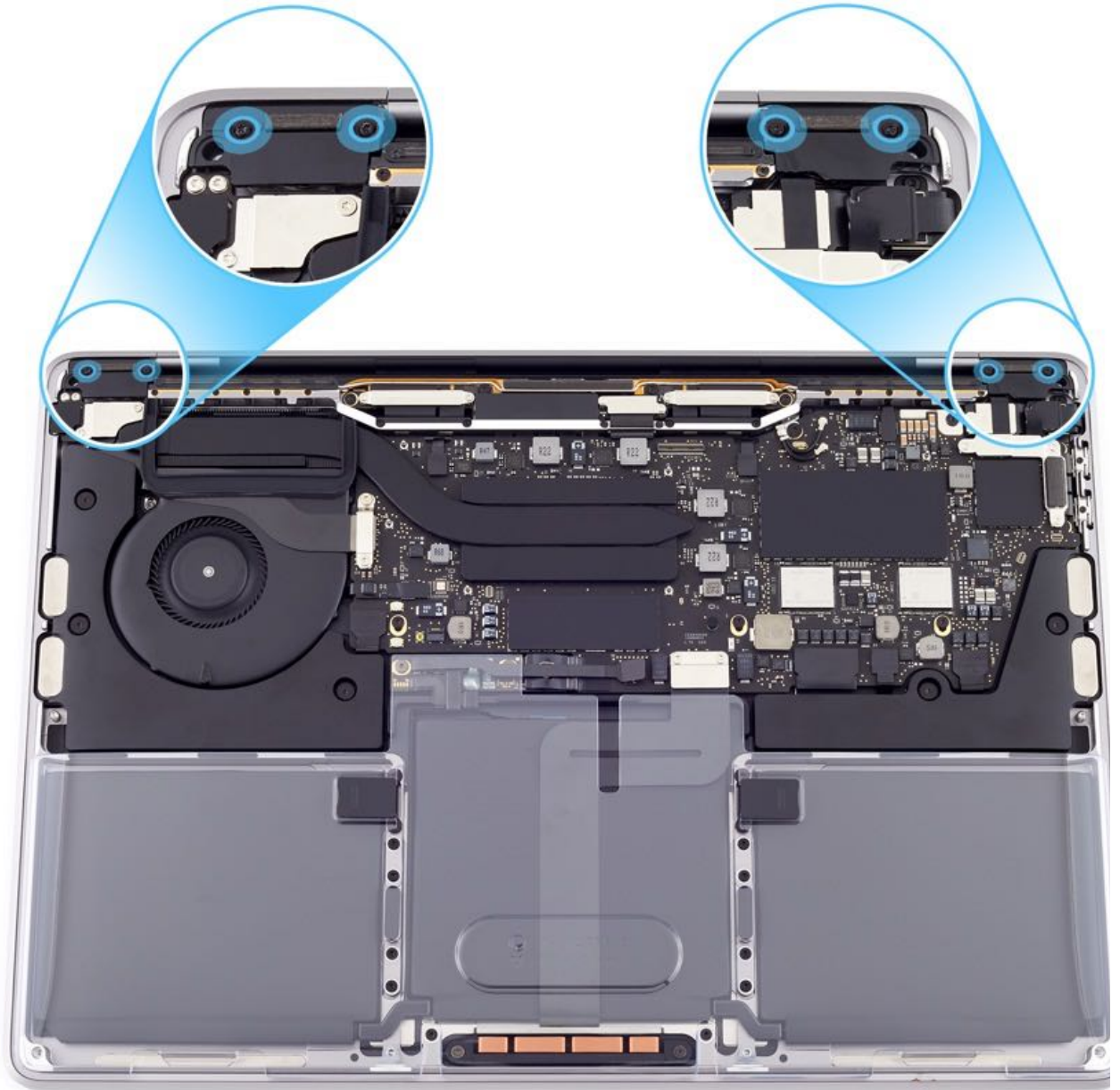
Tools

1. Black stick
2. Torx T3 screwdriver



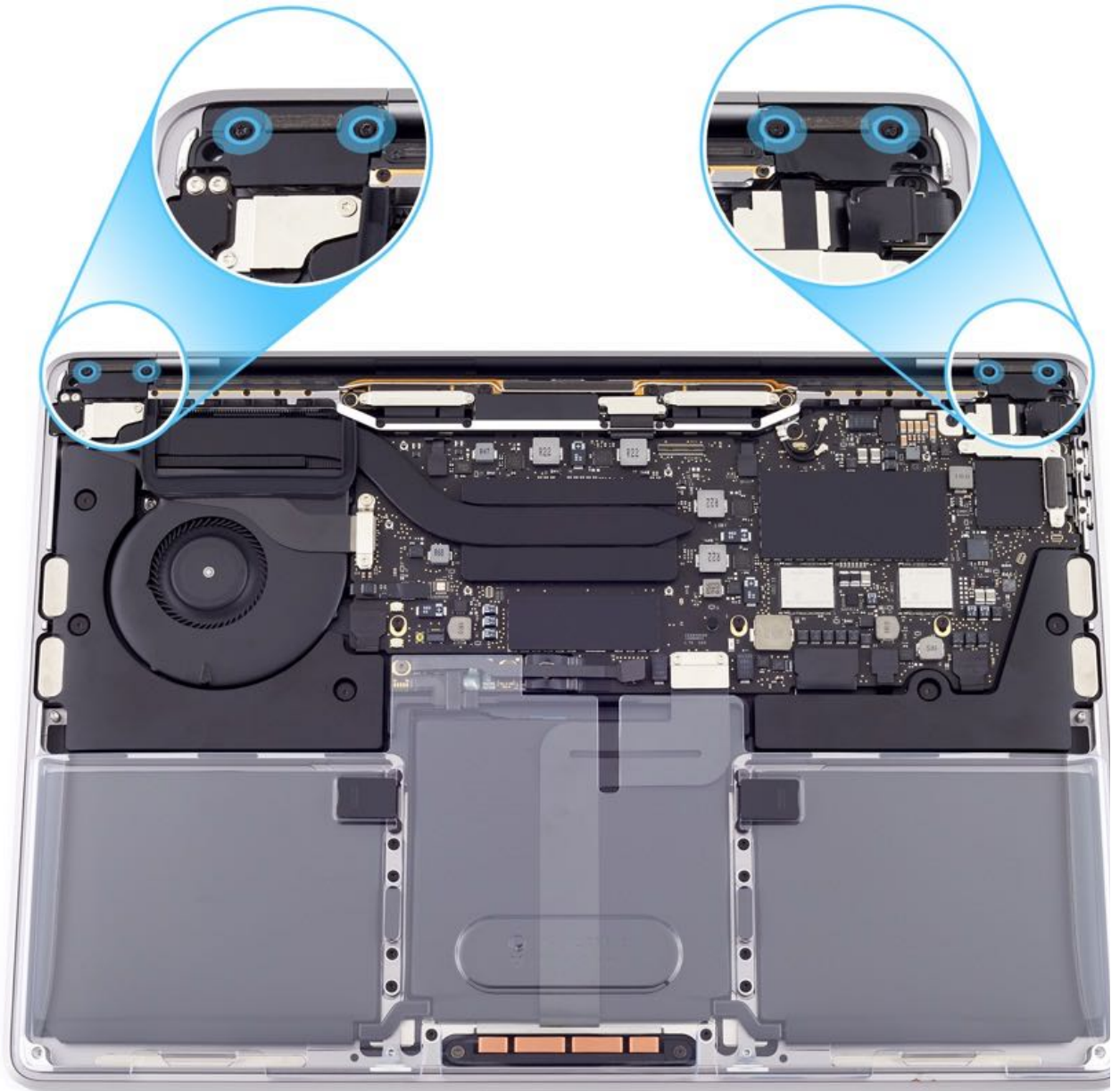
Steps For Removal

1. Remove two T3 screws from each clutch cover. Then, use a black stick to lift the clutch covers out of the top case.



Steps For Reassembly

1. Reinstall the clutch covers in the top case. Ensure the top edge of each clutch cover seats under the top edge of the top case.
2. Reinstall four T3 screws (923-01286), two in each clutch cover.



3. [Reconnect the battery and remove the battery cover](#).
4. Reinstall the [bottom case](#).

Repair Completion:

5. [System Configuration](#) must be performed after a [logic board](#), [Touch ID board](#), [display](#), and [top case](#) repair.
6. Perform the [Trackpad Calibration Check](#) to verify trackpad performance after every repair.

Post Repair Verification:

7. After repair completion, verify the repair was successful by running the [required AST 2 diagnostics based on the repair module that was replaced](#).

MacBook Pro (13-inch, 2020, Two Thunderbolt 3 Ports) Vent/Antenna

First Steps



Caution:

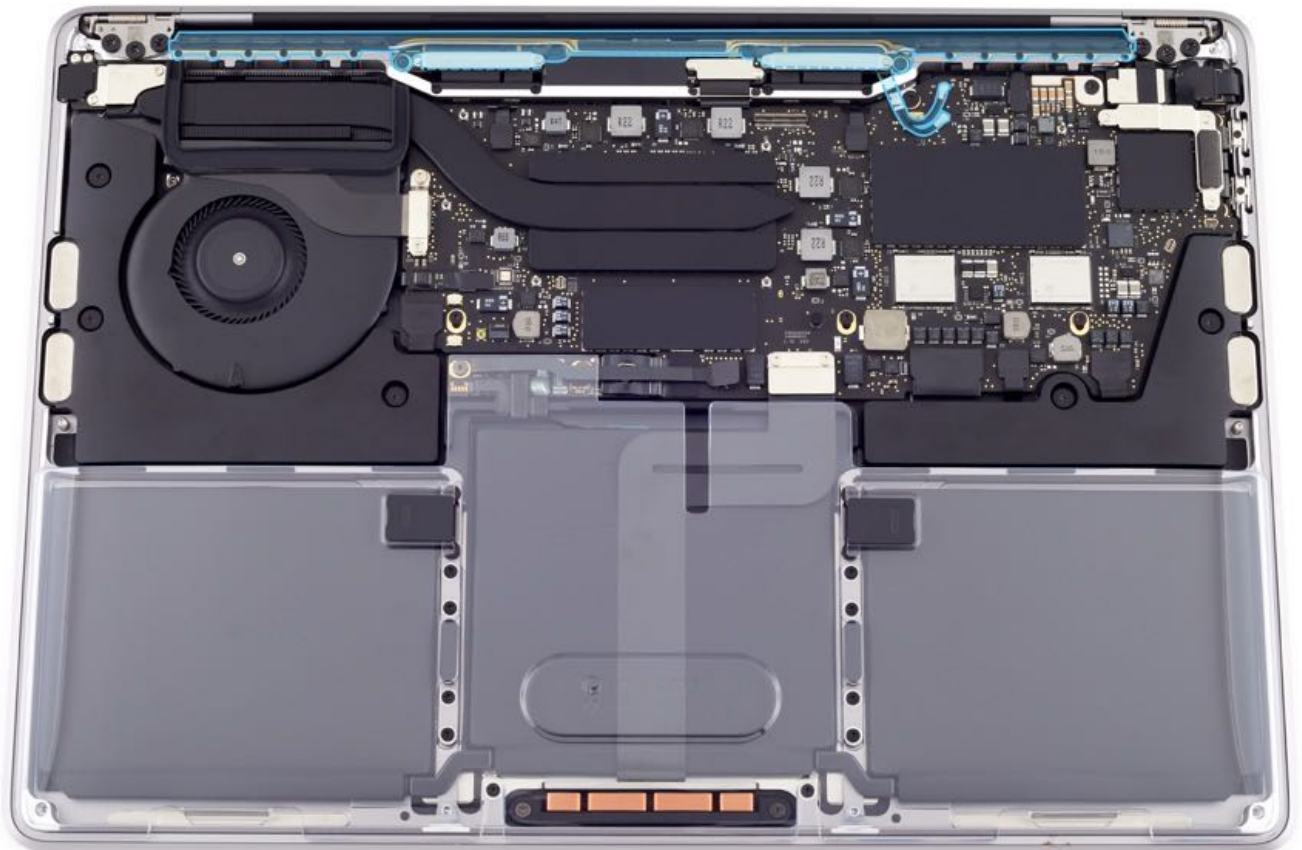
- Only [Apple-certified technicians](#) should perform this procedure.
- To avoid damaging parts, ensure that you have [attached the battery cover and disconnected the battery](#).
- Do not apply external power while the computer is under repair.
- Wear an ESD wrist strap and take precautions to avoid ESD.

Service Videos:

- This procedure contains [solid platform flex connectors](#) and [wireless antenna connectors](#). **Note:**
- Some of the images may be of a different MacBook Pro model, however the procedure is the same for MacBook Pro (13-inch, 2020, Two Thunderbolt 3 Ports).

Remove:

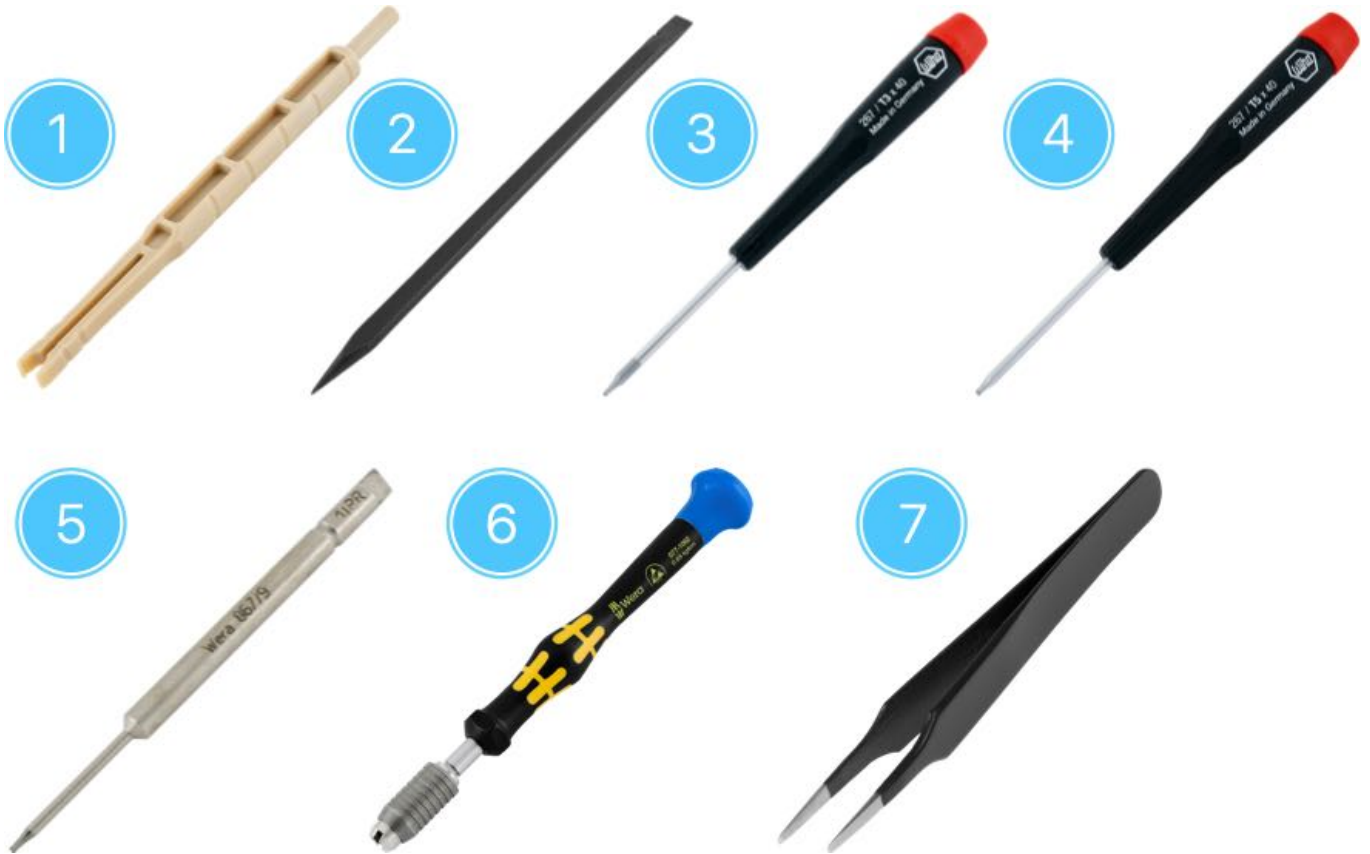
- [Bottom Case](#)
- [Attach the Battery Cover and Disconnect the Battery](#)
- [Clutch Covers](#)



Tools

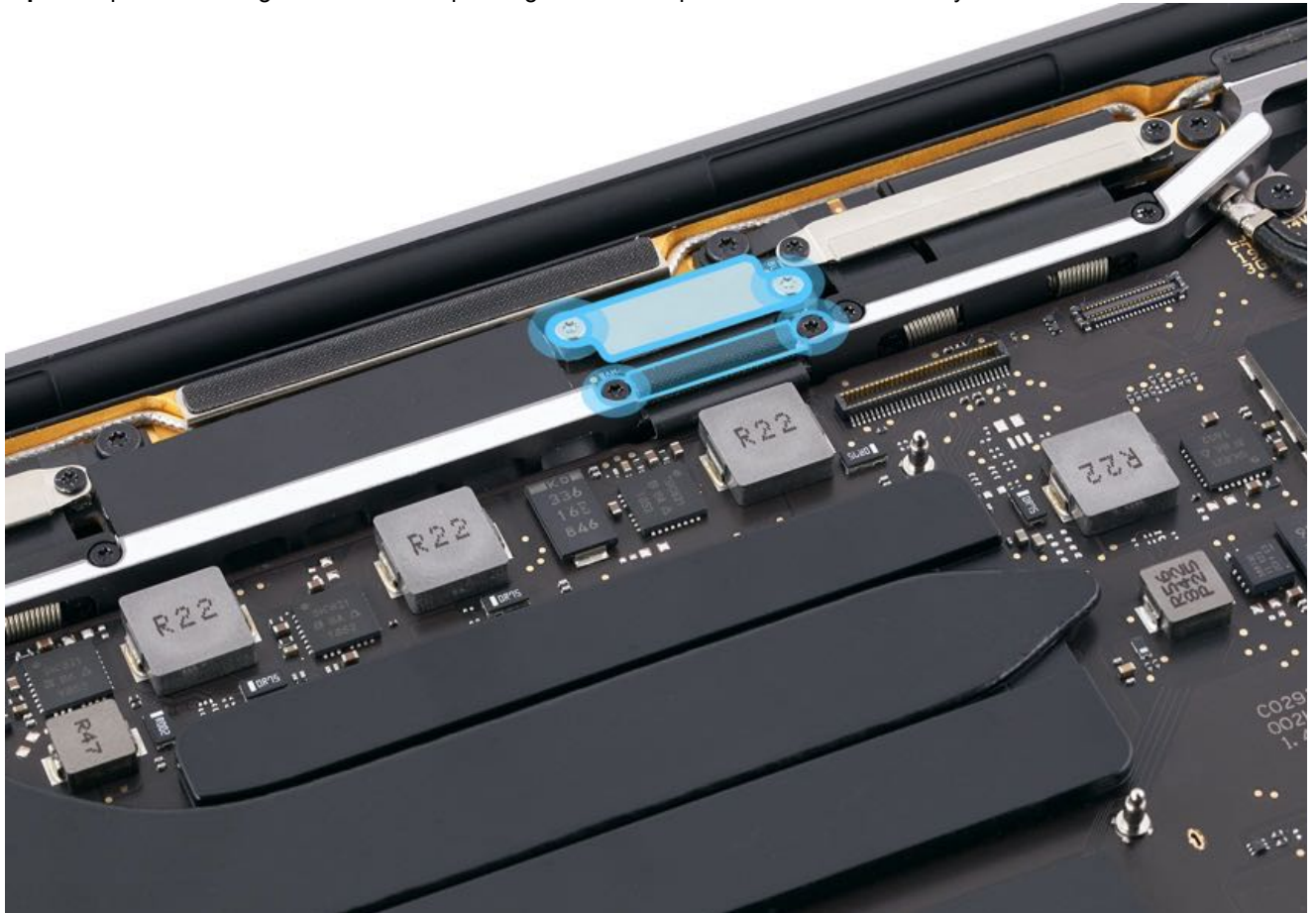
1. Antenna tool (923-01322)
2. Black stick
3. Torx T3 screwdriver
Torx T5 screwdriver

4. Torx T5 screwdriver
5. Torx security bit, 1IPR (923-0247)
6. Torque driver (blue), 0.65kgf-cm (923-0448)
7. ESD-safe tweezers

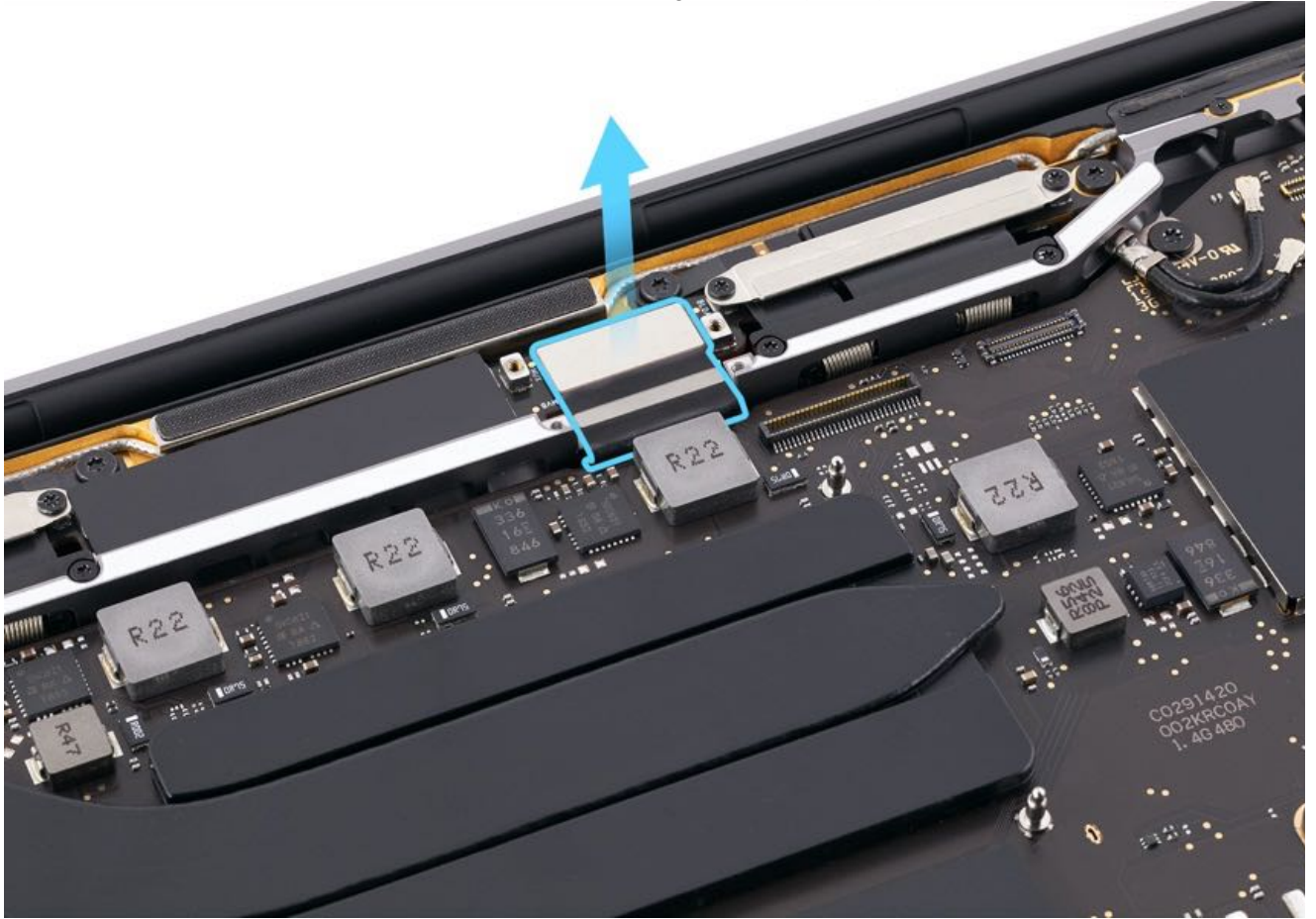


Steps For Removal

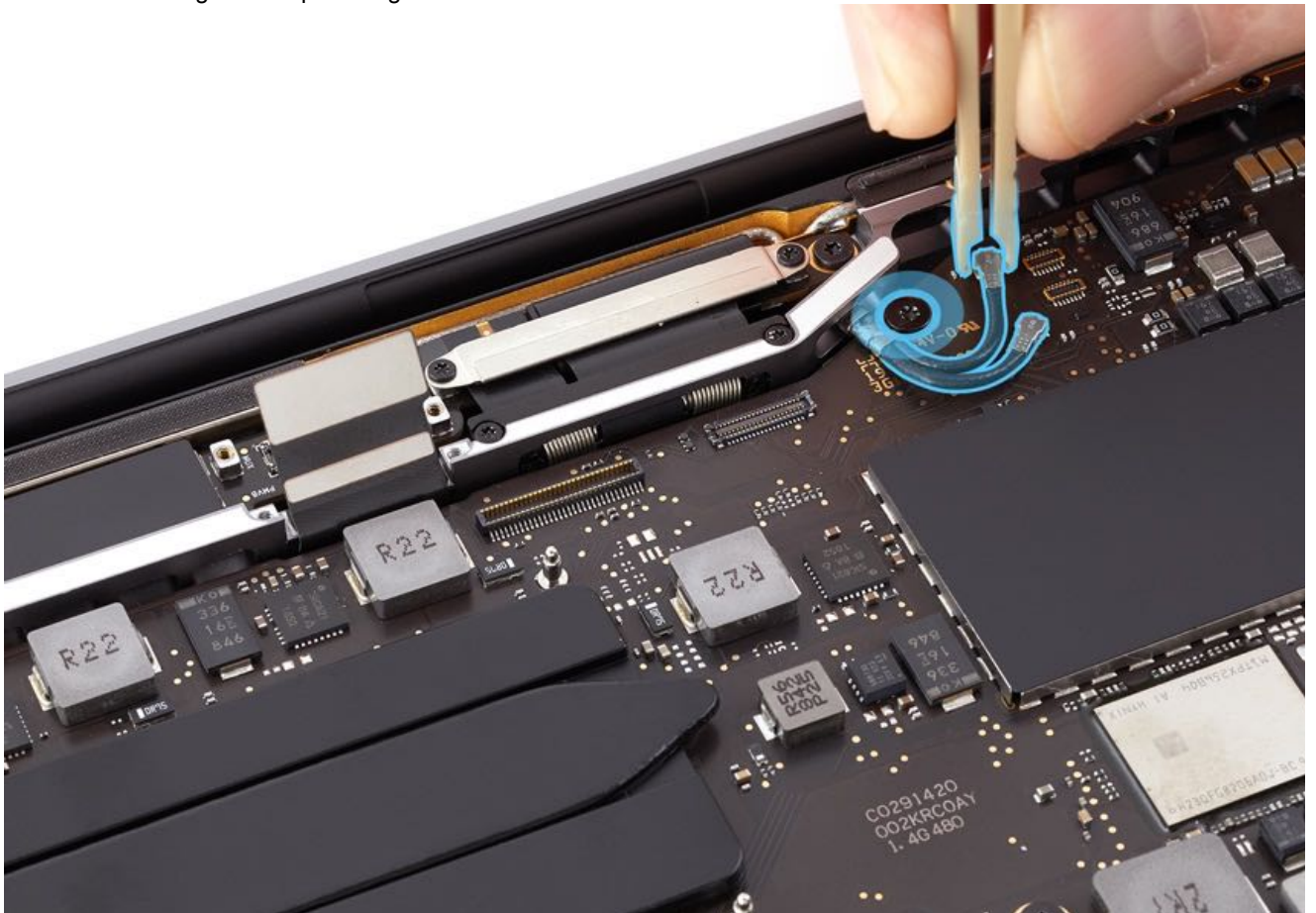
1. Remove four T3 screws, two from the embedded Display Port (eDP) connector cowling and two from the eDP flex cable cowling. Remove the cowlings.
Tip: Group each cowling with their corresponding screws in separate bins of a screw tray.



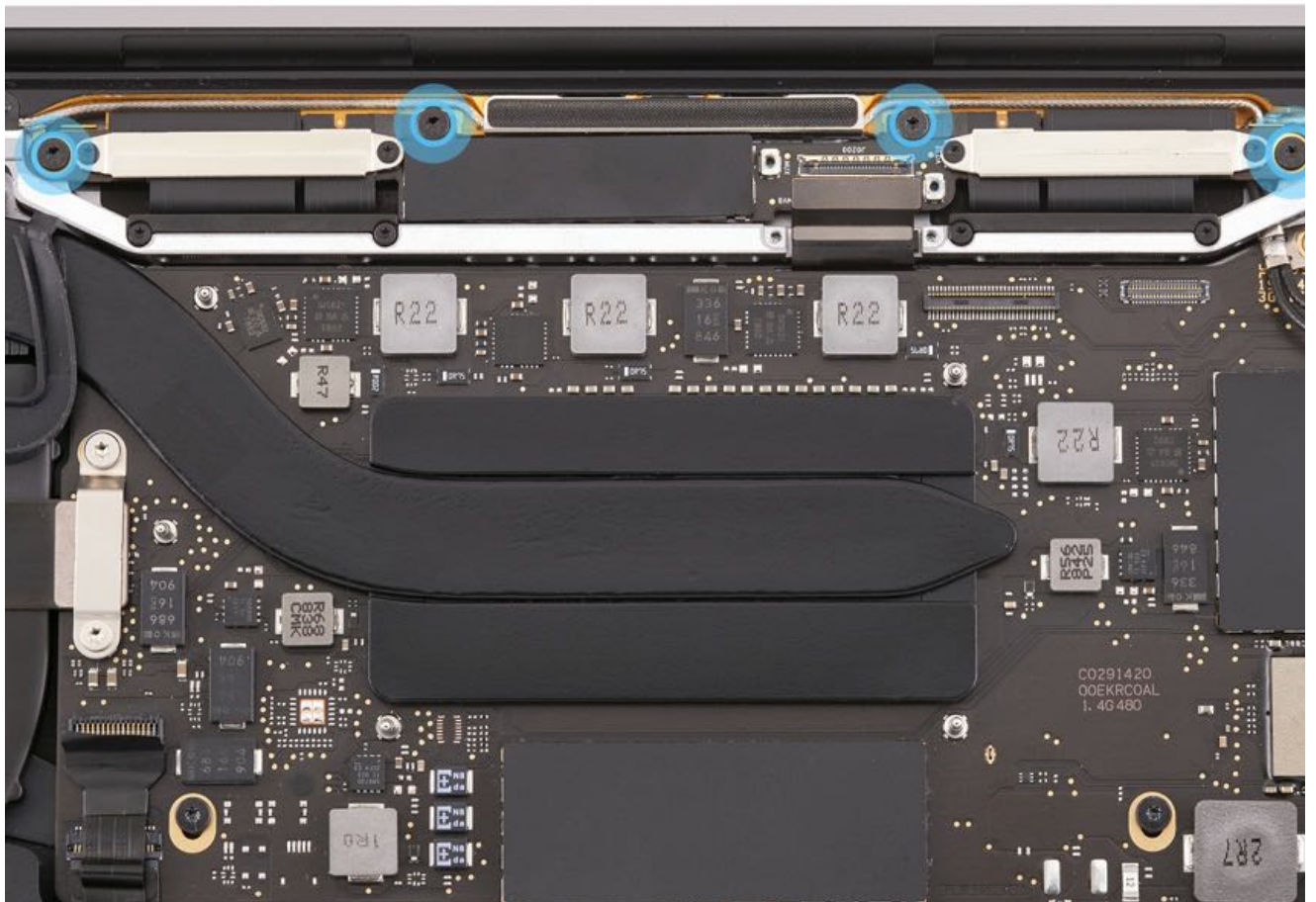
2. Disconnect the eDP flex cable from the connector on the timing controller (TCON) board.



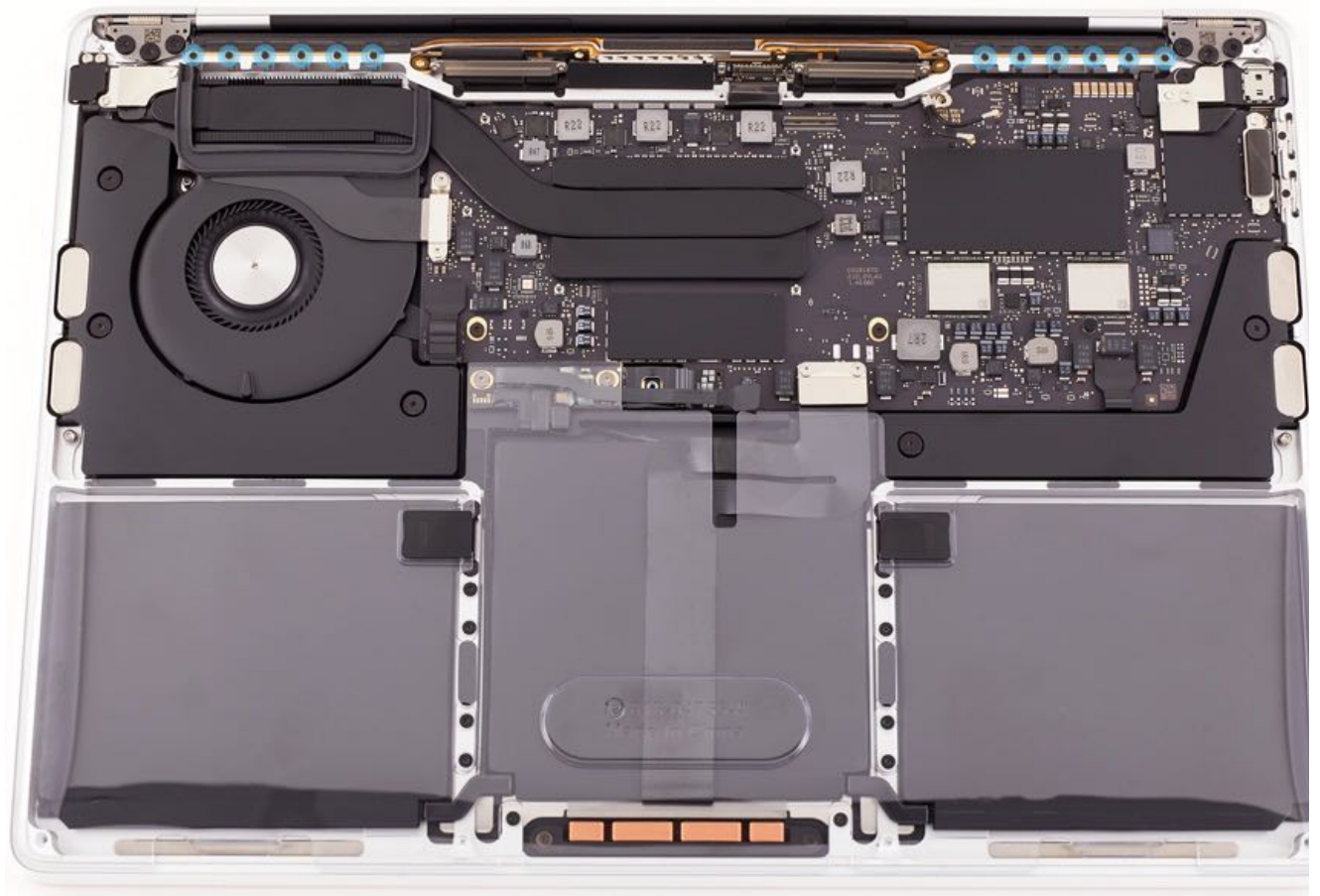
3. Remove and discard the Mylar cover to access the wireless antenna cables and T5 screw.
4. Use the antenna tool to disconnect the two wireless antenna cables from the logic board. Then, remove the T5 screw from the antenna ground clip and logic board.



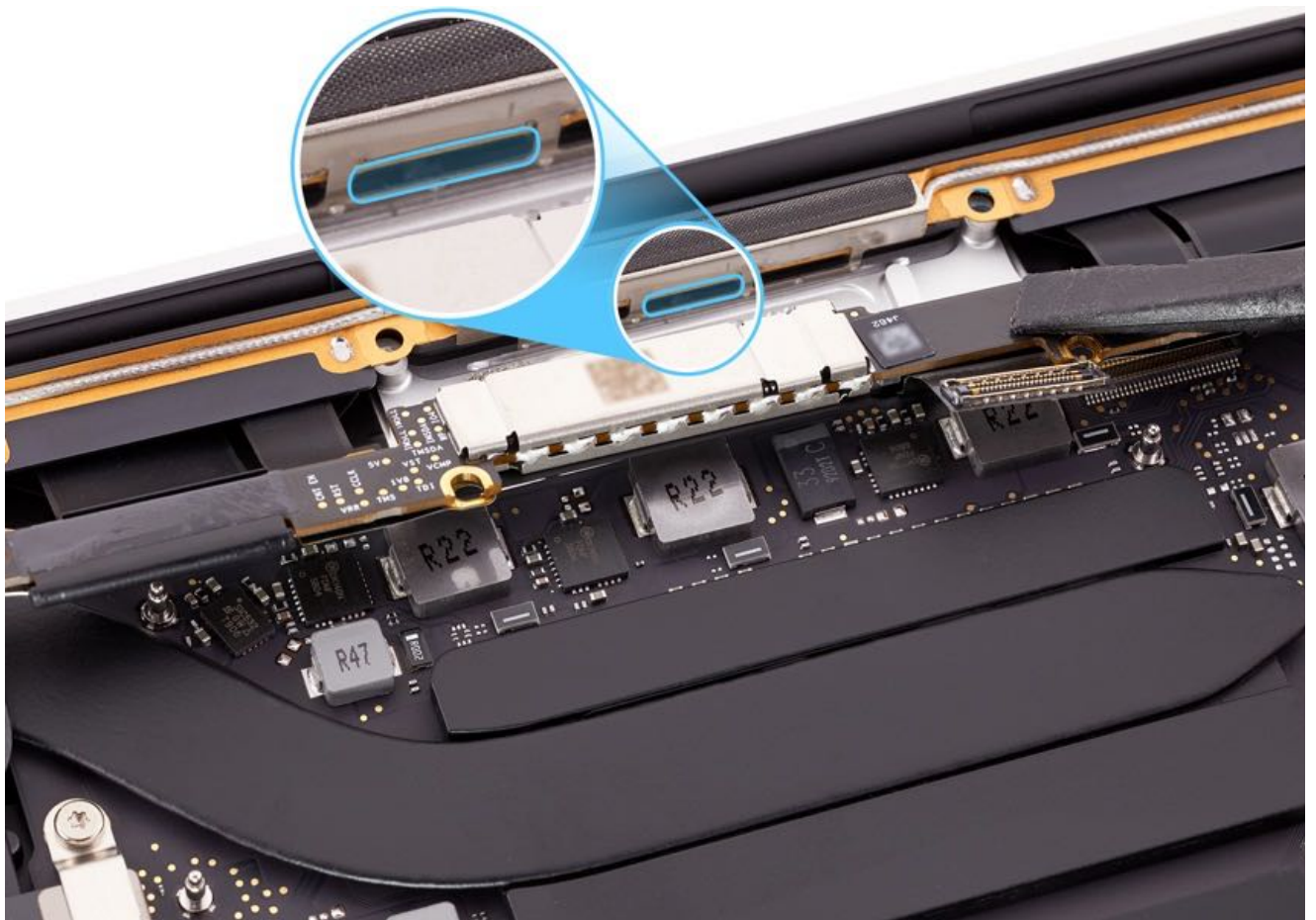
5. Remove four T5 screws from the TCON board.



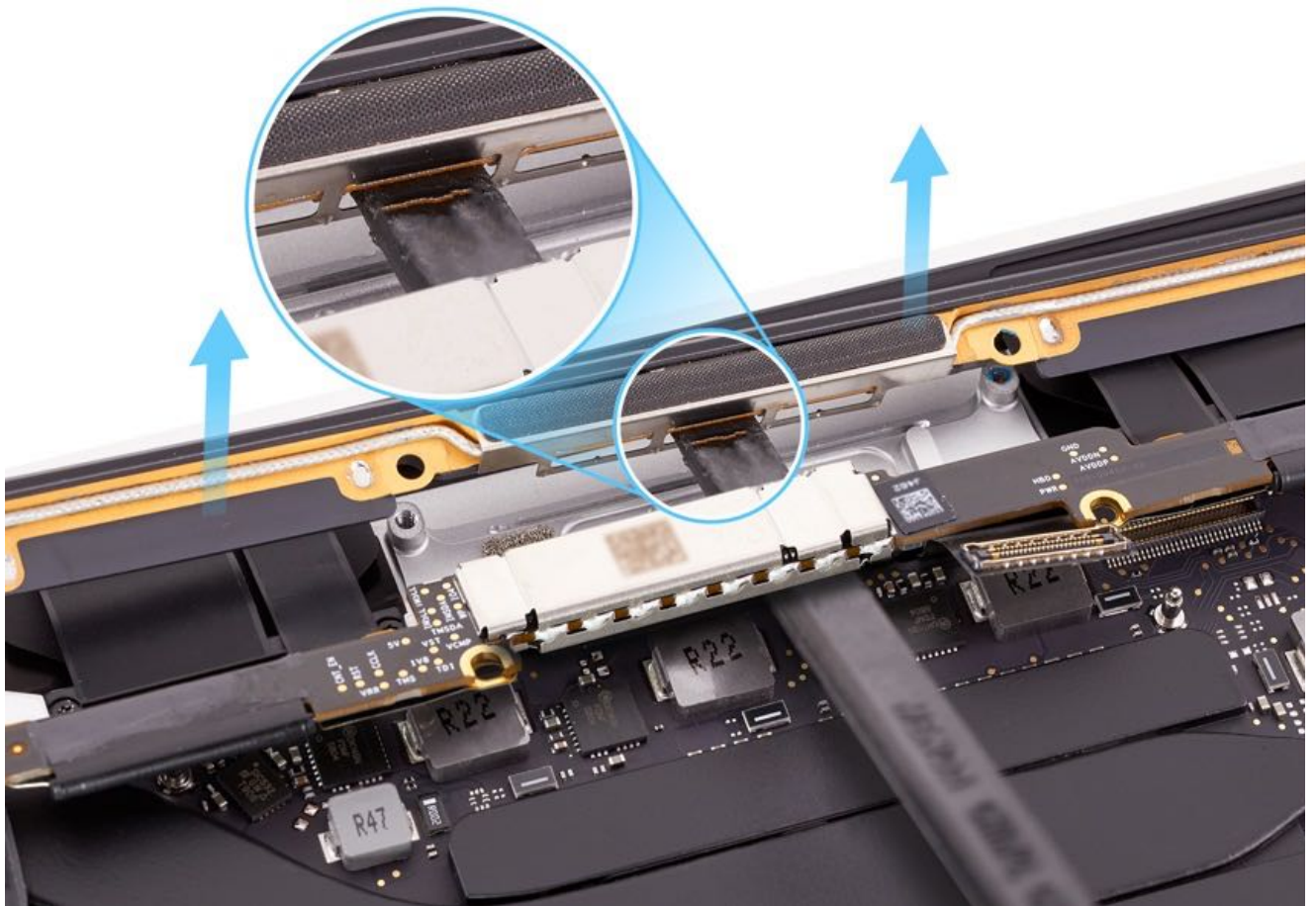
6. Use the torque driver (blue) with the Torx security bit to remove twelve 1IPR screws on the vent/antenna.



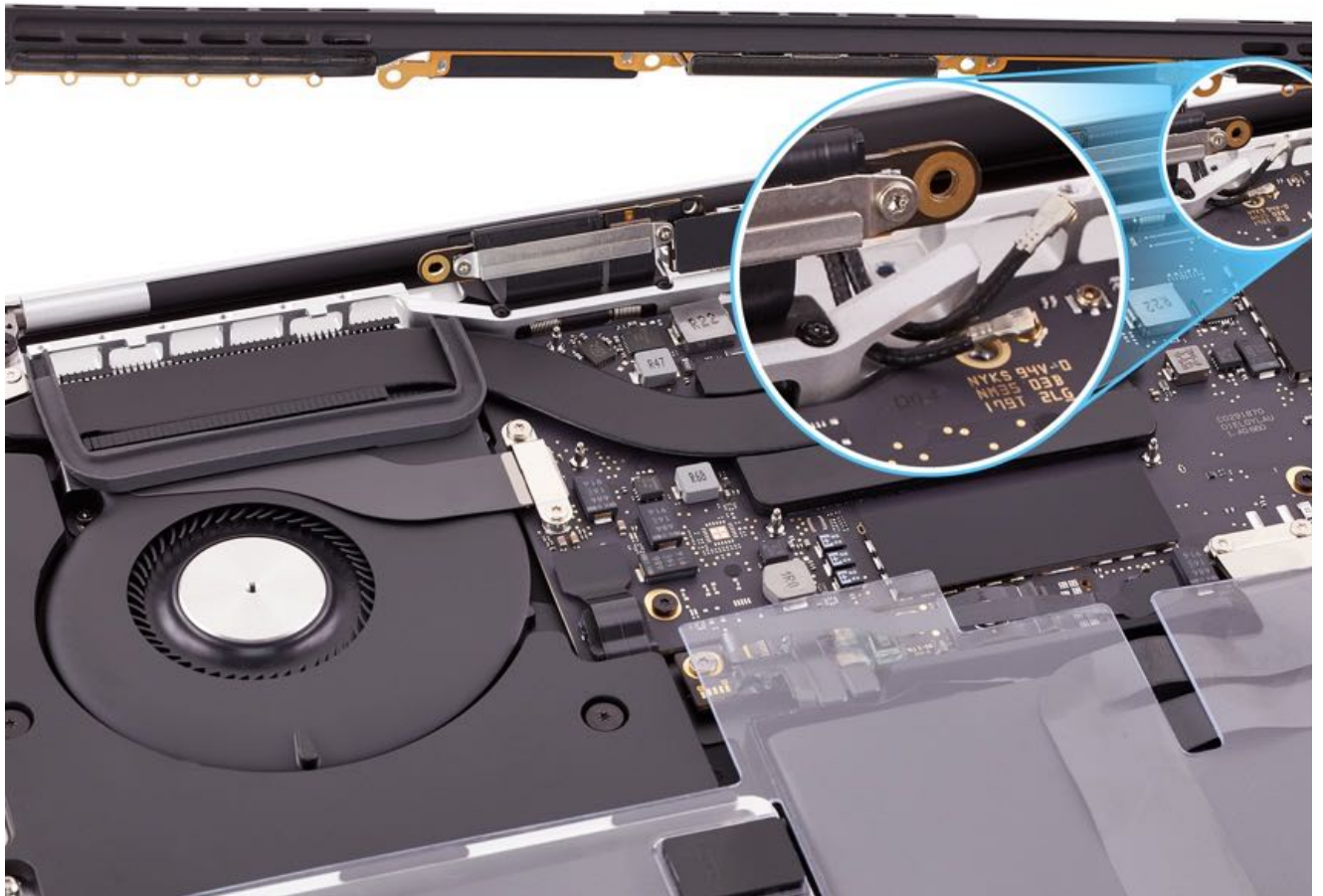
7. Gently lift the TCON board to locate the middle vent slot in the vent/antenna.



8. Guide the flat end of a black stick under the TCON board. Insert the flat end of the black stick into the middle vent slot. Press down on the pointed end of the black stick to lift the vent/antenna up.
Note: You may hear a slight click when the vent/antenna unclips from the top case.

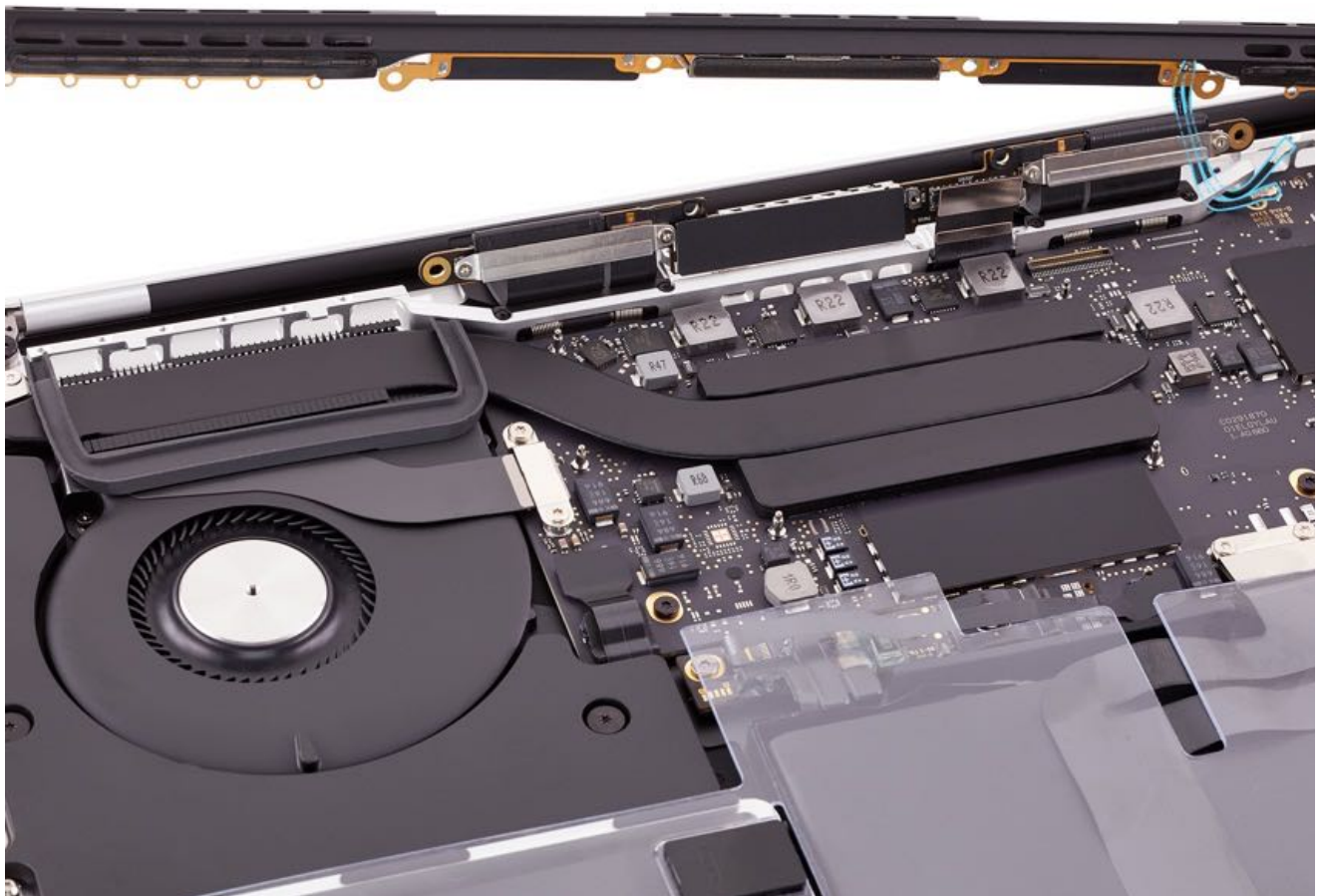


9. Carefully guide the antenna cables and antenna ground clip through the opening in the rear wall as you lift the vent/antenna out of the top case.



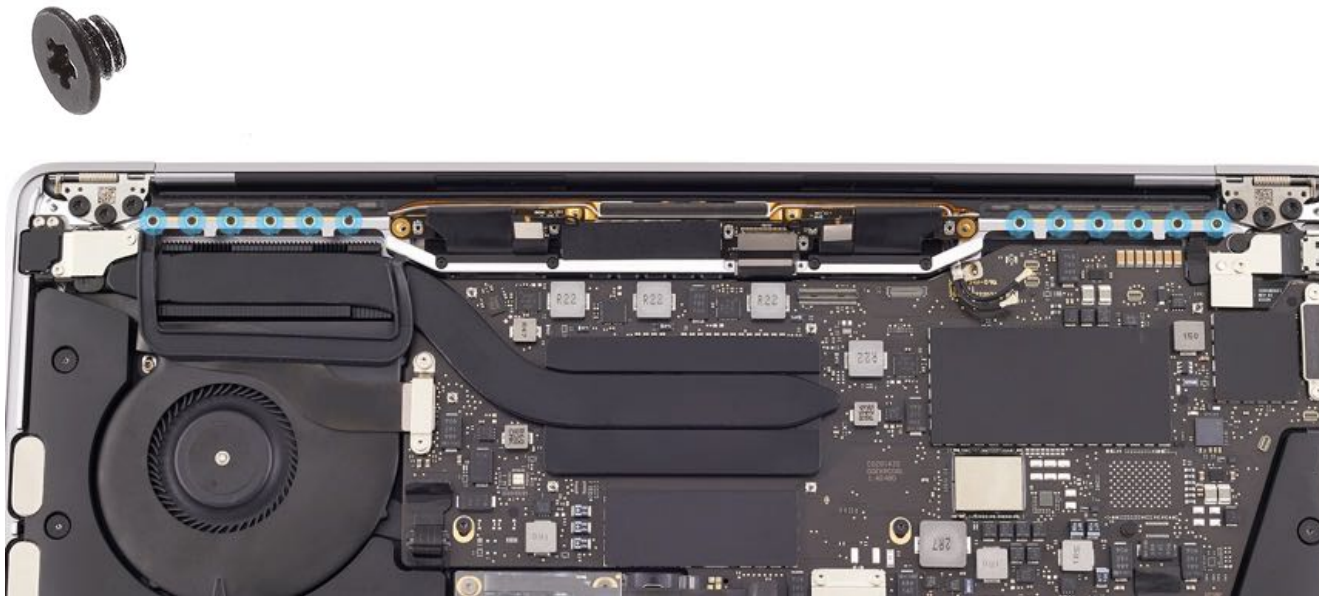
Steps For Reassembly

1. Route the two antennas and antenna ground clip through the opening in the rear wall. Lower the vent/antenna into the top case. Gently press down on the middle of the vent/antenna to seat it in the top case.
Note: Pressing the vent/antenna into the top case may produce an audible click.

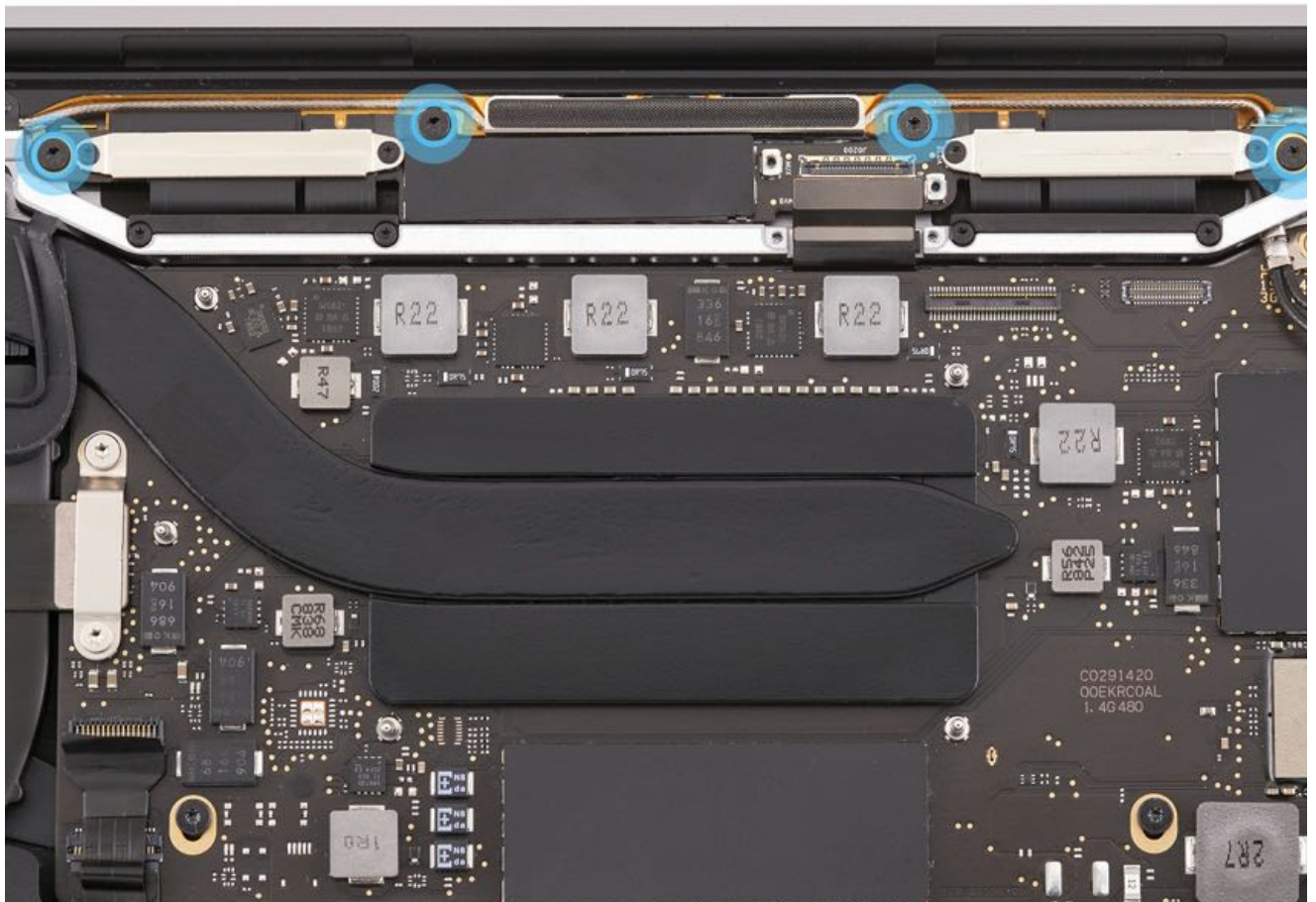


2. Use the torque driver (blue) to reinstall the twelve 1IPR screws (923-04191) in the vent/antenna. Tighten each screw until the torque driver clicks (applies the correct torque).

Important: Don't overtighten the screws. The torque driver should prevent overtightening, however some screws may install fully without the torque driver producing an audible click.



3. Reinstall four T5 screws (923-03284) in the TCON board.

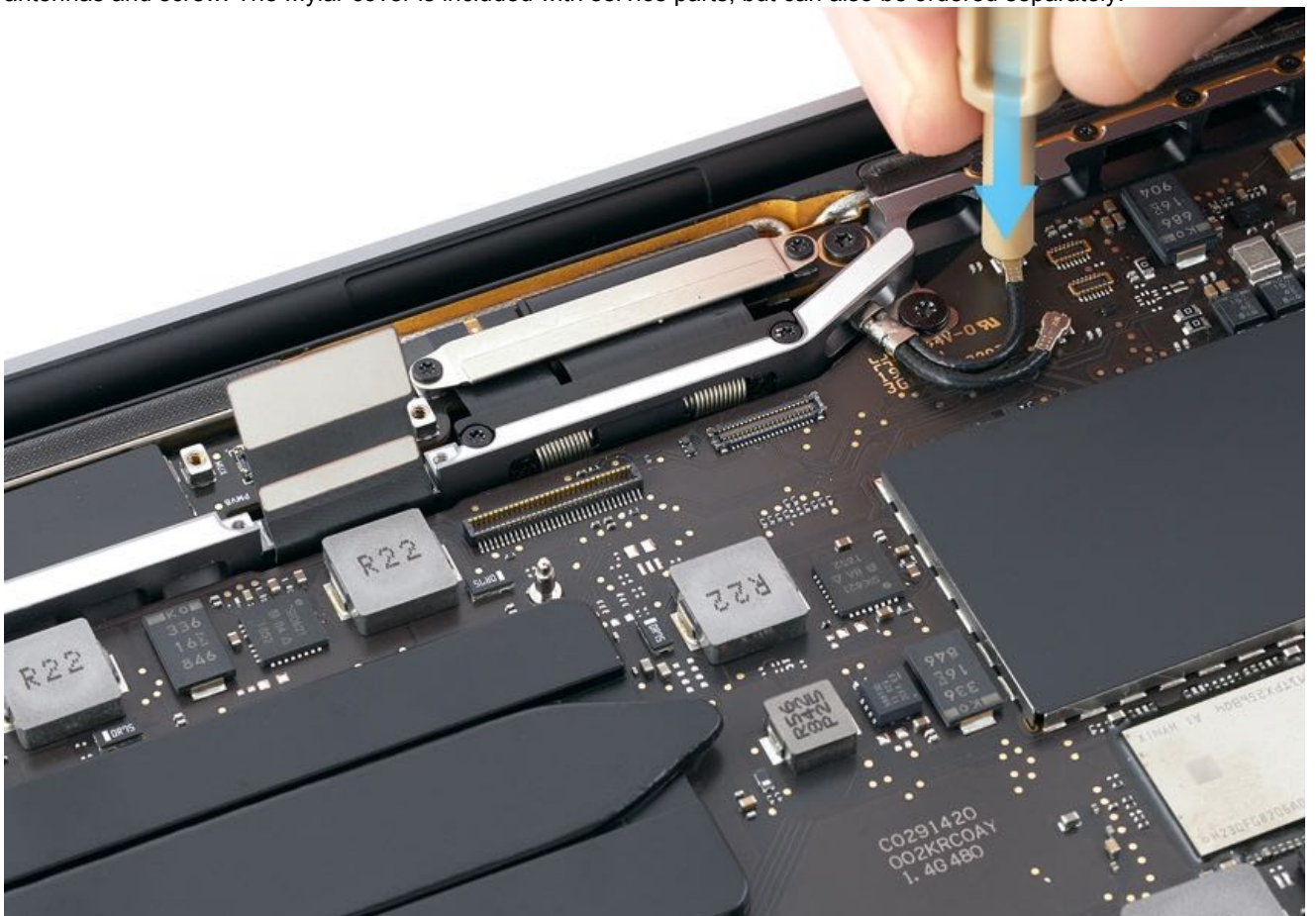


4. Reinstall the one T5 screw (923-04256) to the antenna ground clip and logic board.

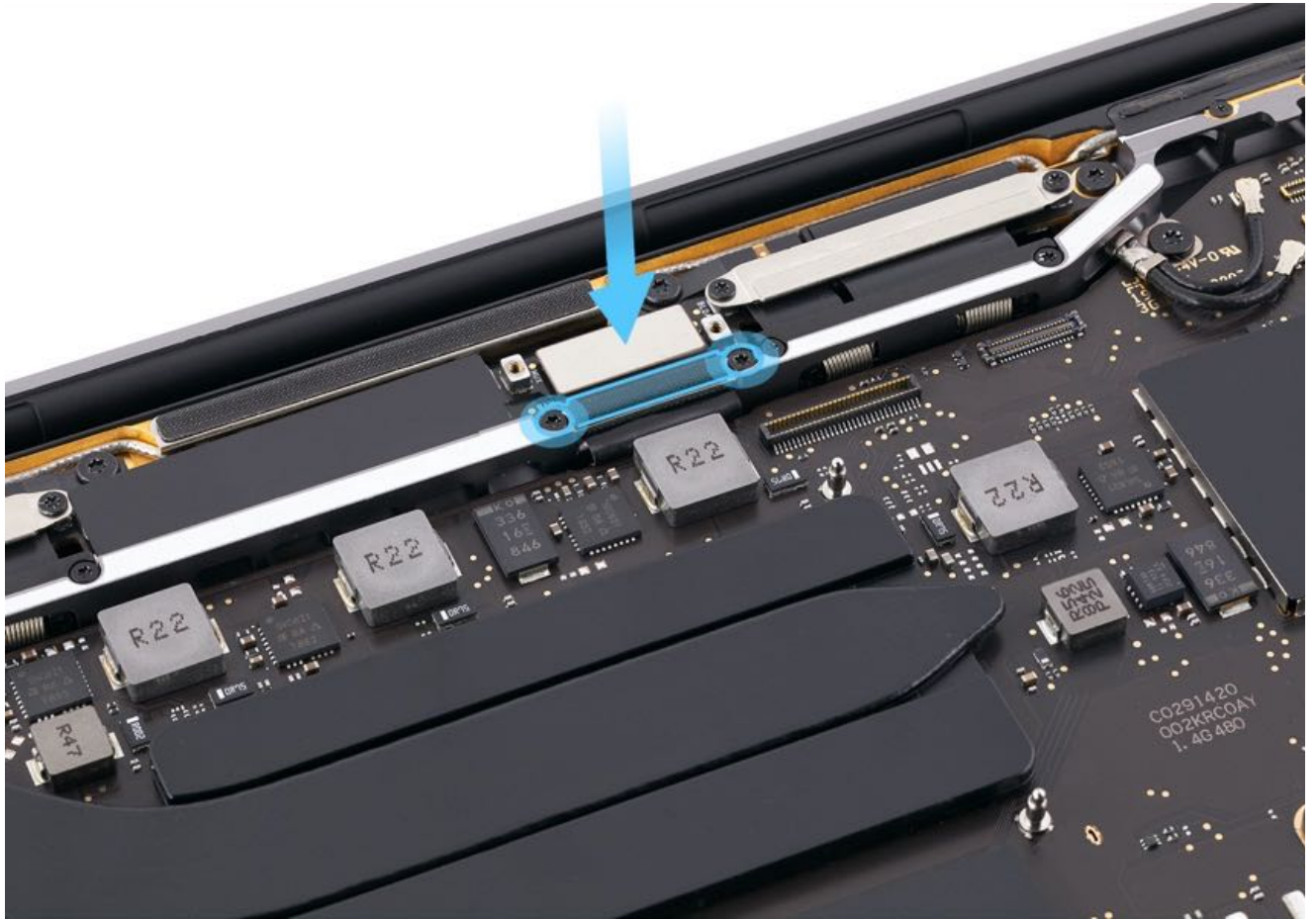




5. Align the antenna heads over the antenna connectors on the logic board. Use the opposite end of the antenna tool to press the three antenna heads onto the antenna connectors.
6. **Caution:** To prevent damage caused by loose debris, install a new Mylar cover (923-04328) over the wireless antennas and screw. The Mylar cover is included with service parts, but can also be ordered separately.



7. Reconnect the eDP flex cable to the connector on the TCON board. Then reinstall the eDP flex cable cowling (923-04172) and two T3 screws (923-03286).



8. Reinstall the eDP connector cowling (923-01310) and the two T3 screws (923-04193).





9. Reinstall the [clutch covers](#).
10. [Reconnect the battery and remove the battery cover](#).
11. Reinstall the [bottom case](#).

Repair Completion:

12. [System Configuration](#) must be performed after a [logic board](#), [Touch ID board](#), [display](#), and [top case](#) repair.
13. Perform the [Trackpad Calibration Check](#) to verify trackpad performance after every repair.

Post Repair Verification:

14. After repair completion, verify the repair was successful by running the [required AST 2 diagnostics based on the repair module that was replaced](#).

MacBook Pro (13-inch, 2020, Two Thunderbolt 3 Ports) Display

First Steps



Caution:

- Only [Apple-certified technicians](#) should perform this procedure.
- To avoid damaging parts, ensure that you have [attached the battery cover and disconnected the battery](#) .
- Do not apply external power while the computer is under repair.
- Wear an ESD wrist strap and take precautions to avoid ESD.

System Configuration:

- [System Configuration](#) must be performed after a [logic board](#), [Touch ID board](#), [display](#), and [top case](#) repair. **Note:**
- Some of the images may be of a different MacBook Pro model, however the procedure is the same for MacBook Pro (13-inch, 2020, Two Thunderbolt 3 Ports).

Remove:

- [Bottom Case](#)
- [Attach the Battery Cover and Disconnect the Battery](#)
- [Clutch Covers](#)
- [Vent/Antenna Module](#)



Tools

1. Black stick
2. Torx T3 screwdriver

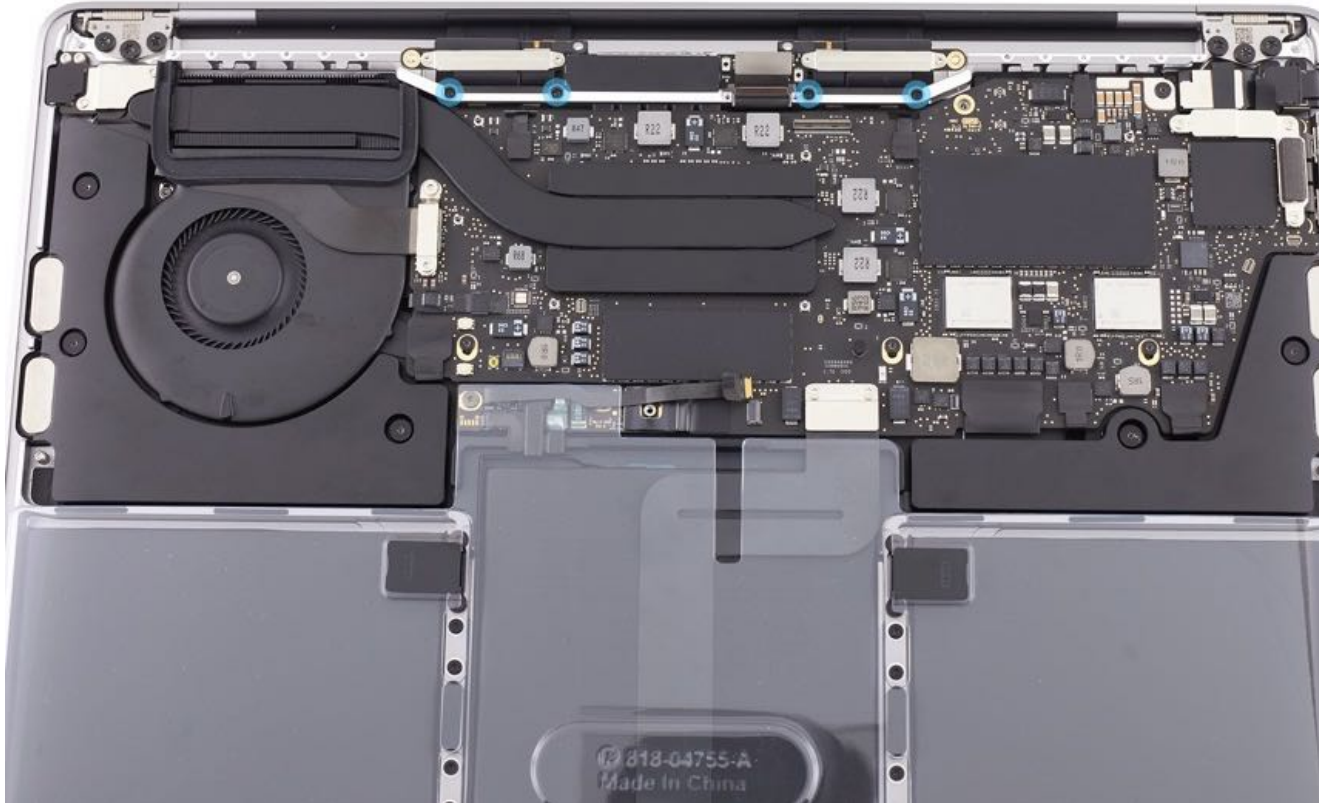
3. Torx T8 screwdriver



Steps For Removal

1. Remove four T3 screws from the spring tensioners.

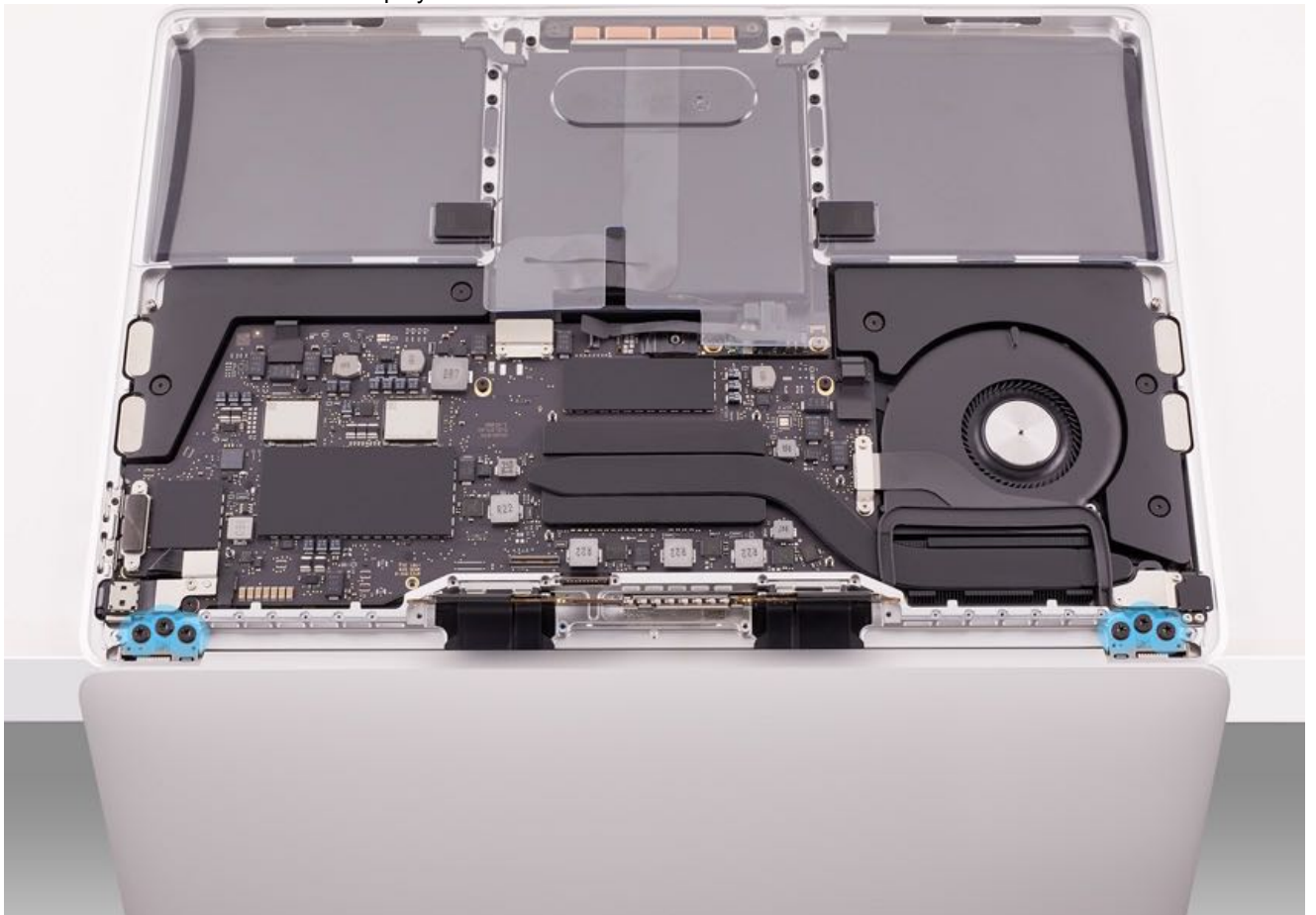
Note: The spring tensioners and timing controller (TCON) board are part of the display.



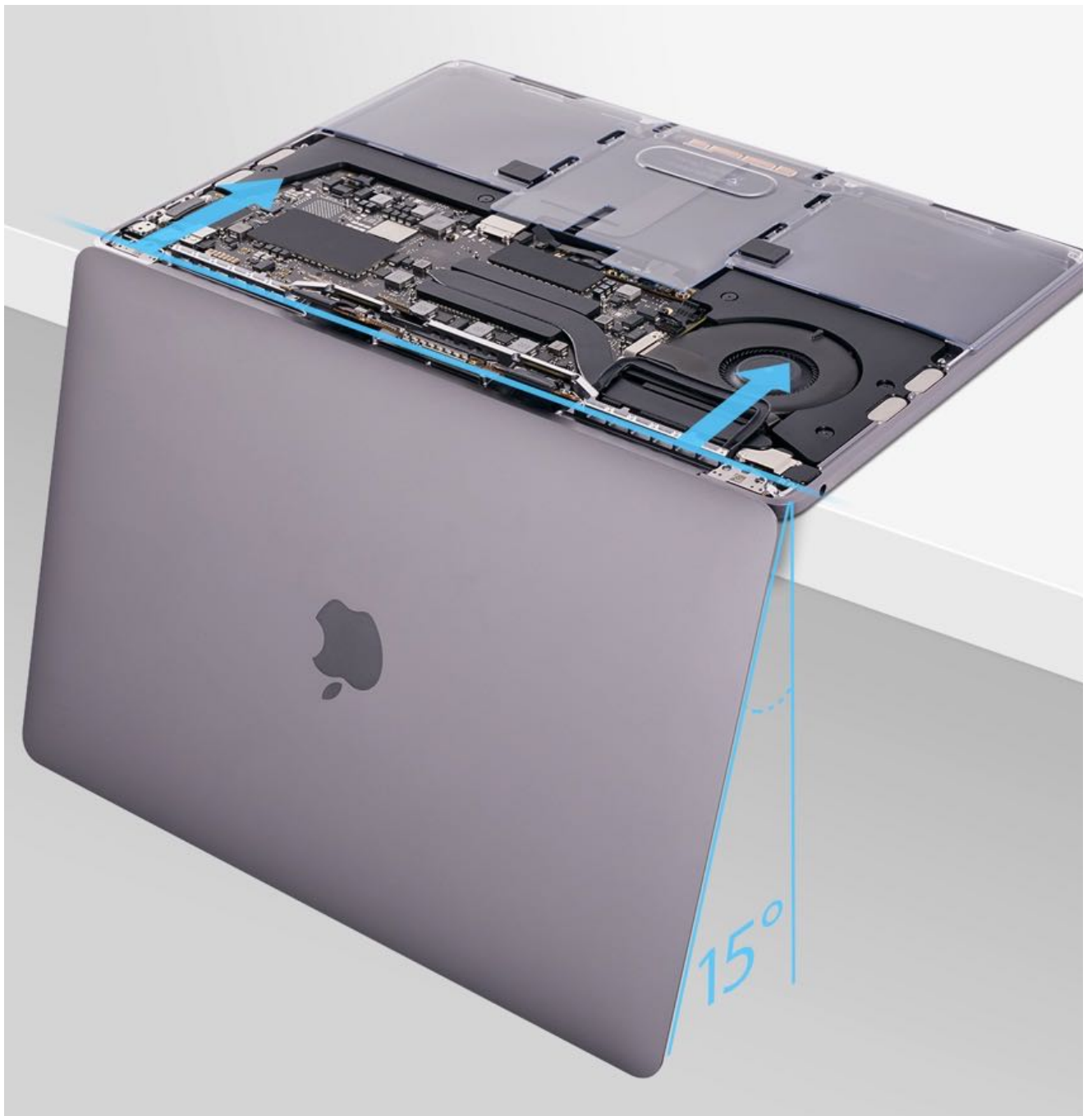
2. Open the display and place the computer on the edge of a workbench, with the display hanging down.



3. Remove six T8 screws from the display clutch mounts.



4. Separate the display from the top case. Pull the display toward you about 15 degrees, then lift the display up and out of the top case.



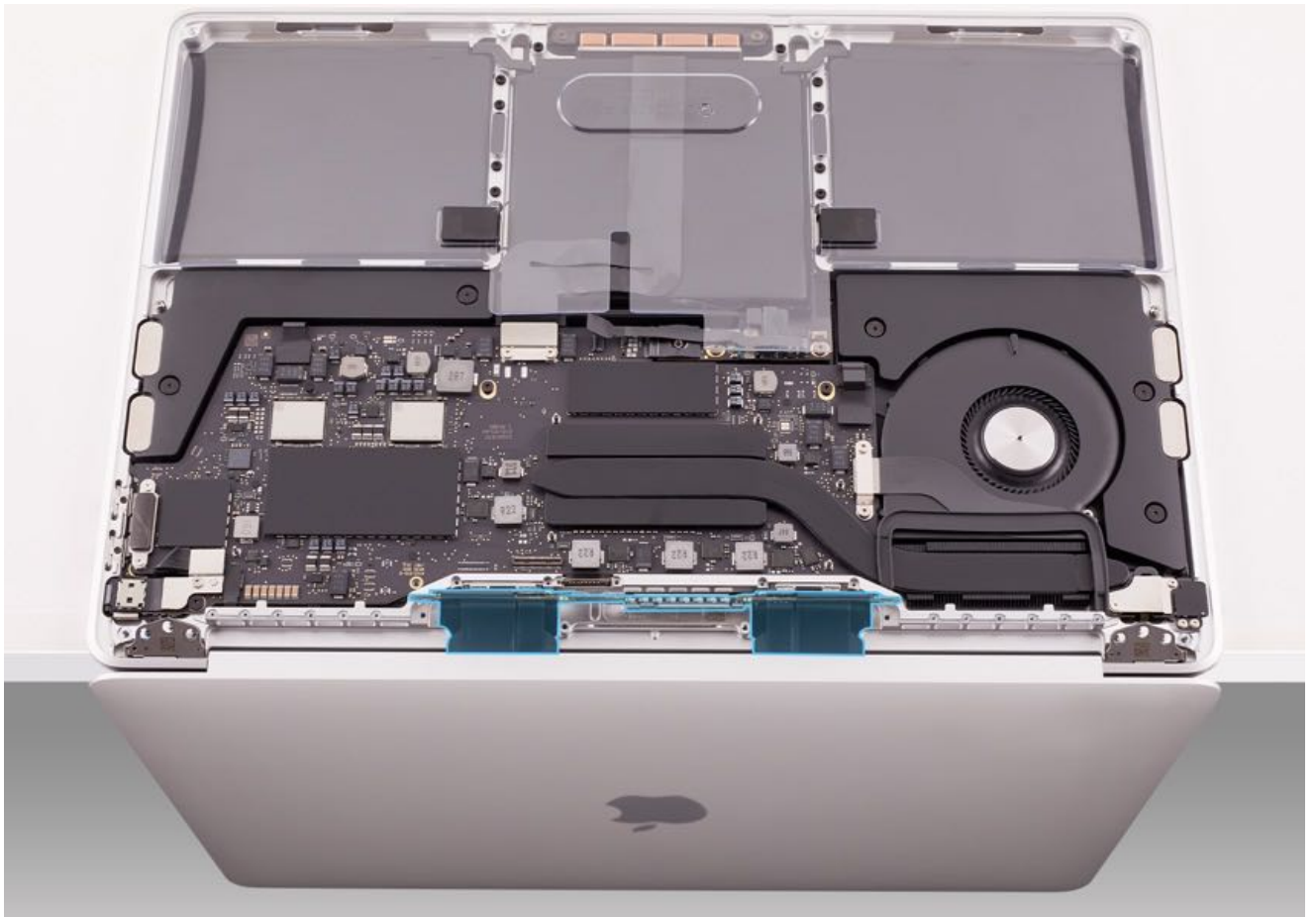
Steps For Reassembly



Caution: If reassembled incorrectly, the TCON board and spring tensioners could get wedged between the top case and display, as shown below.



1. Reinstall the display into the top case. Make sure that the TCON board and spring tensioners are positioned in the top case.



2. Partially reinstall the six T8 screws (923-04189) in the order shown.



3. Close the computer and adjust the display alignment to the top case by touch.



4. Stand up the computer on a clean, flat surface to level the front-to-rear clutch alignment.



5. With the display closed, fully tighten the six T8 screws.



6. Roll and tuck the body of each spring tensioner so it sits flush against the rear wall. The spring tensioner cables should lay completely flat in the top case. The four screw holes in the body of the spring tensioners should align with the screw holes in the rear wall.



7. Reinstall the four T3 screws (923-04190) in the spring tensioners.





8. Reinstall the [vent/antenna module](#).
9. Reinstall the [clutch covers](#).
10. [Reconnect the battery and remove the battery cover](#).
11. Reinstall the [bottom case](#).

Repair Completion:

12. [System Configuration](#) must be performed after a [logic board](#), [Touch ID board](#), [display](#), and [top case](#) repair.
13. Perform the [Trackpad Calibration Check](#) to verify trackpad performance after every repair.

Post Repair Verification:

14. After repair completion, verify the repair was successful by running the [required AST 2 diagnostics based on the repair module that was replaced](#).

MacBook Pro (13-inch, 2020, Two Thunderbolt 3 Ports) Audio Board Flex Assembly

First Steps



Caution:

- Only [Apple-certified technicians](#) should perform this procedure.
- To avoid damaging parts, ensure that you have [attached the battery cover and disconnected the battery](#)
- Do not apply external power while the computer is under repair.
- Wear an ESD wrist strap and take precautions to avoid ESD.

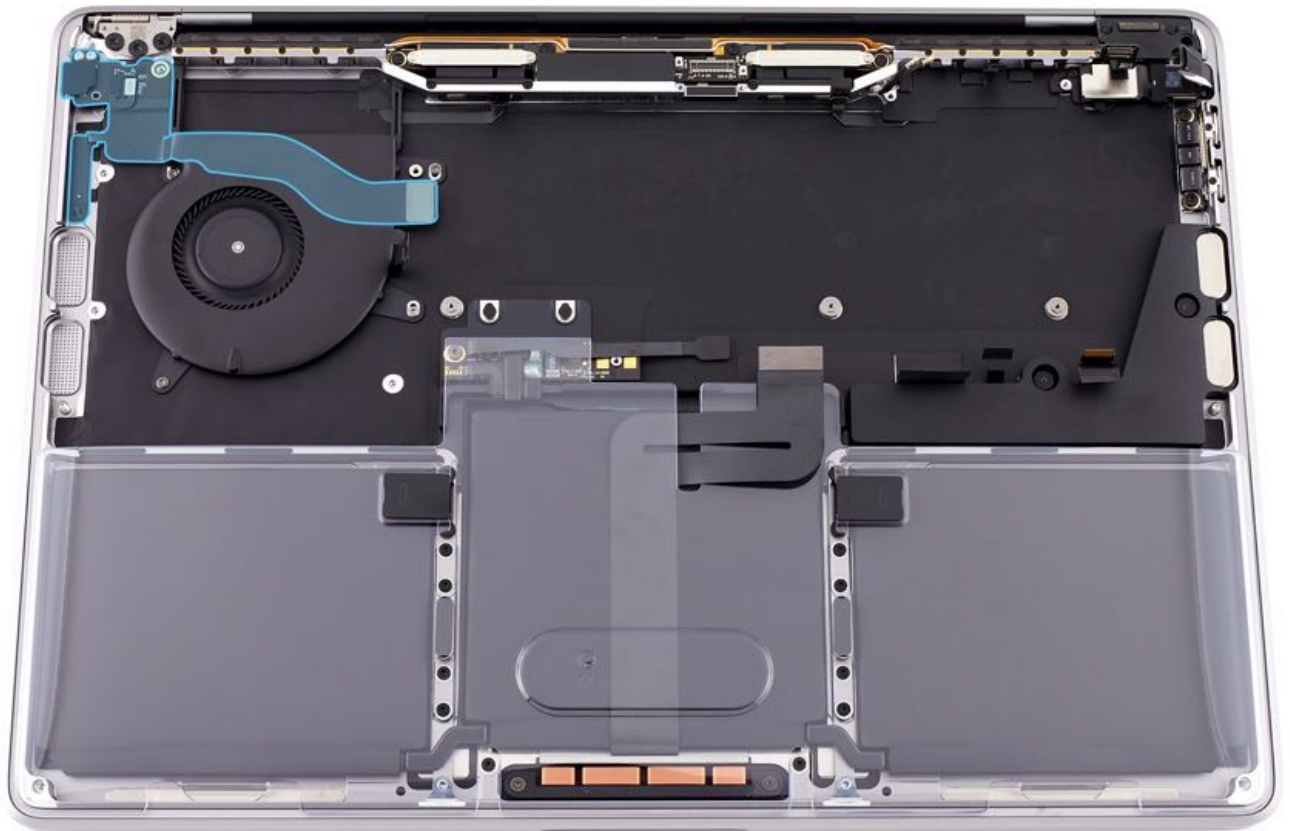
Important:

- A new audio board flex assembly must be installed every time it is removed from the top case.

Service Videos:

Remove:

- [Bottom Case](#)
- [Attach the Battery Cover and Disconnect the Battery](#)
- [Logic Board](#)
- [Clutch Cover](#) (right only)
- [Speaker](#) (right only)



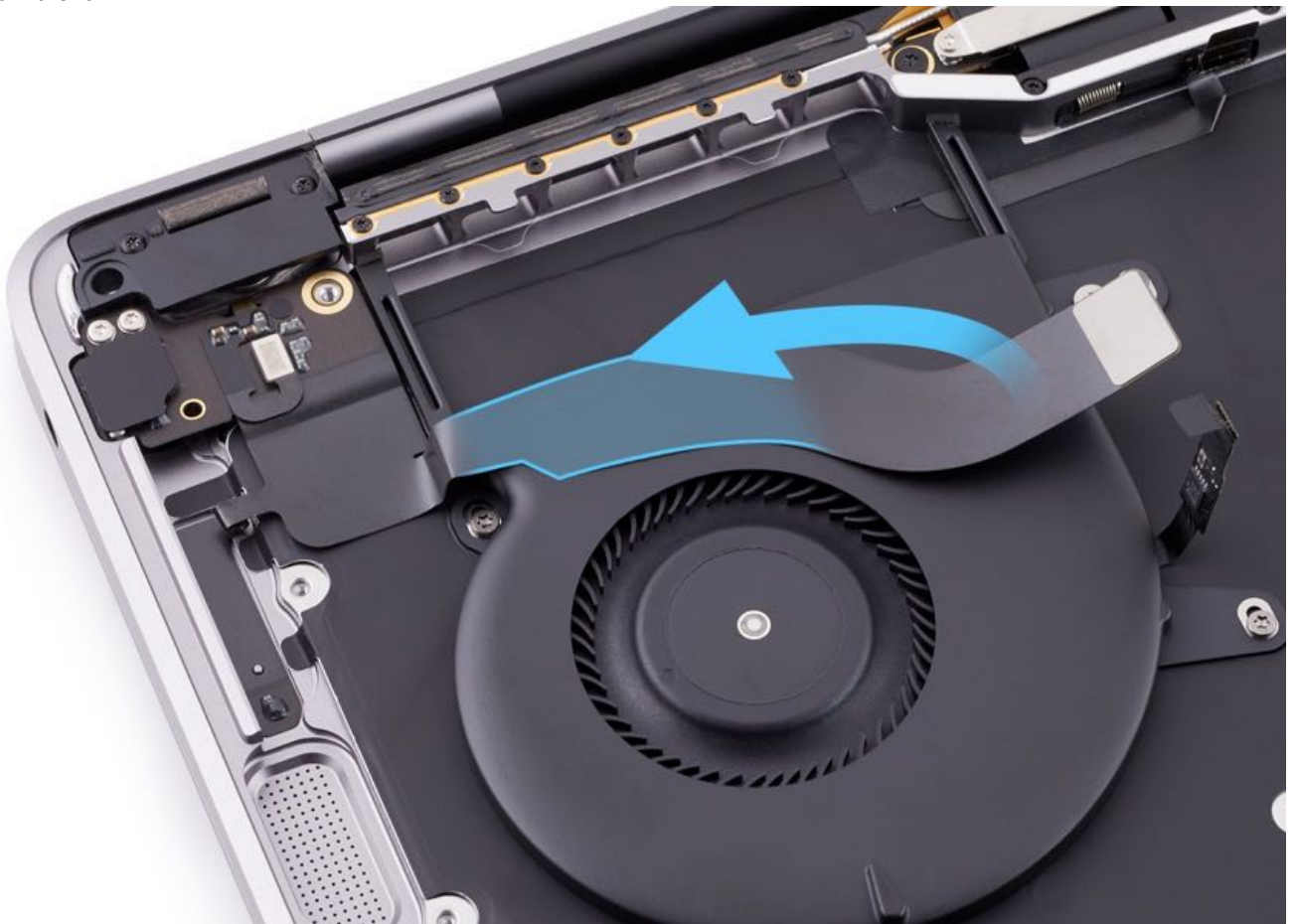
Tools

1. Torx T3 screwdriver
2. Black stick
3. ESD-safe tweezers
4. EarPods with 3.5 mm headphone jack

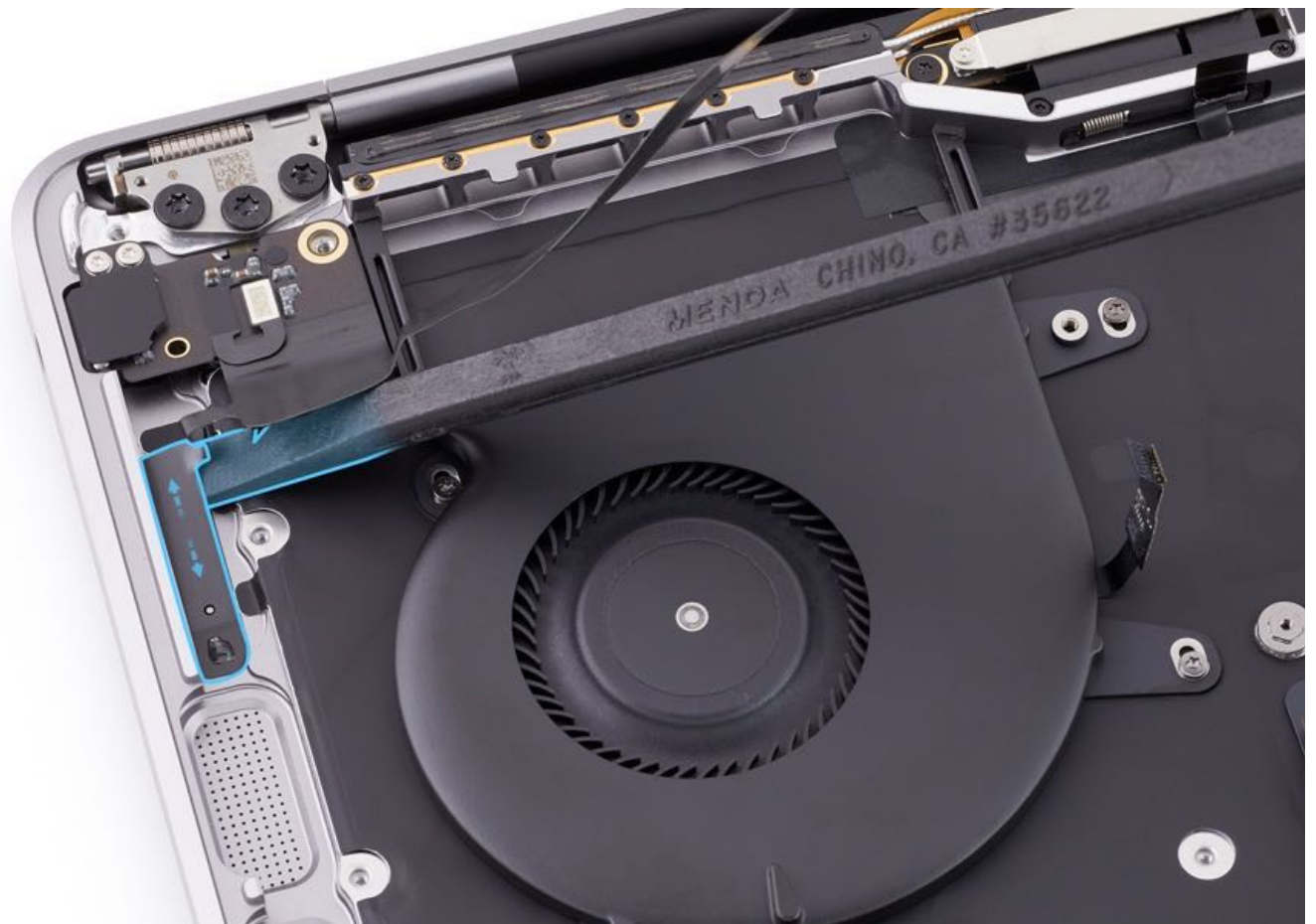


Steps For Removal

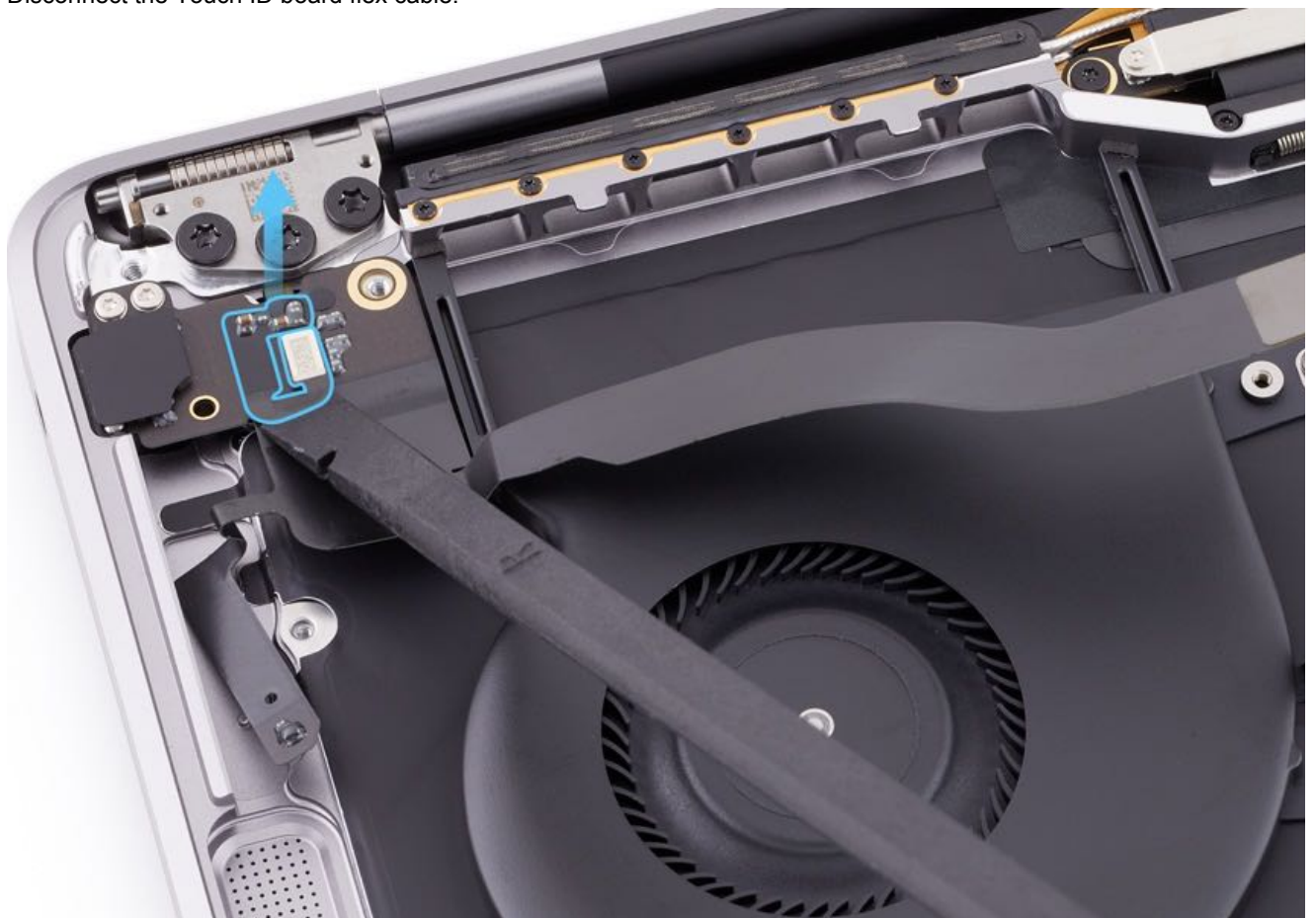
1. The audio board flex assembly cable is adhered to the fan. Gently lift the cable to loosen the adhesive and separate it from the fan.



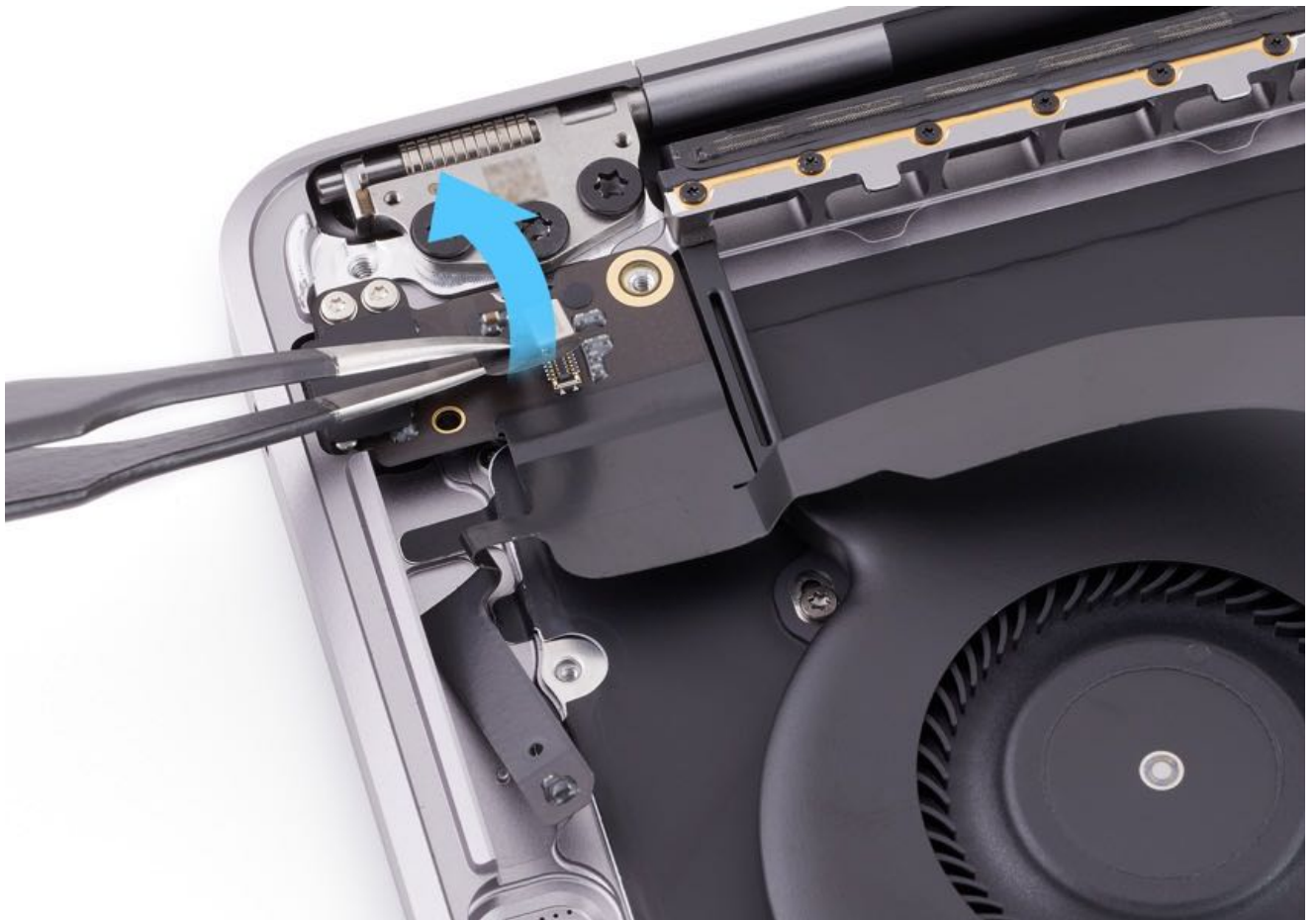
2. **Caution:** Don't bend or crimp the Hall effect sensor cable. The Hall effect sensor cable is adhered to the top case. Run the flat end of a black stick under the Hall effect sensor cable to loosen the adhesive and separate it from the top case.



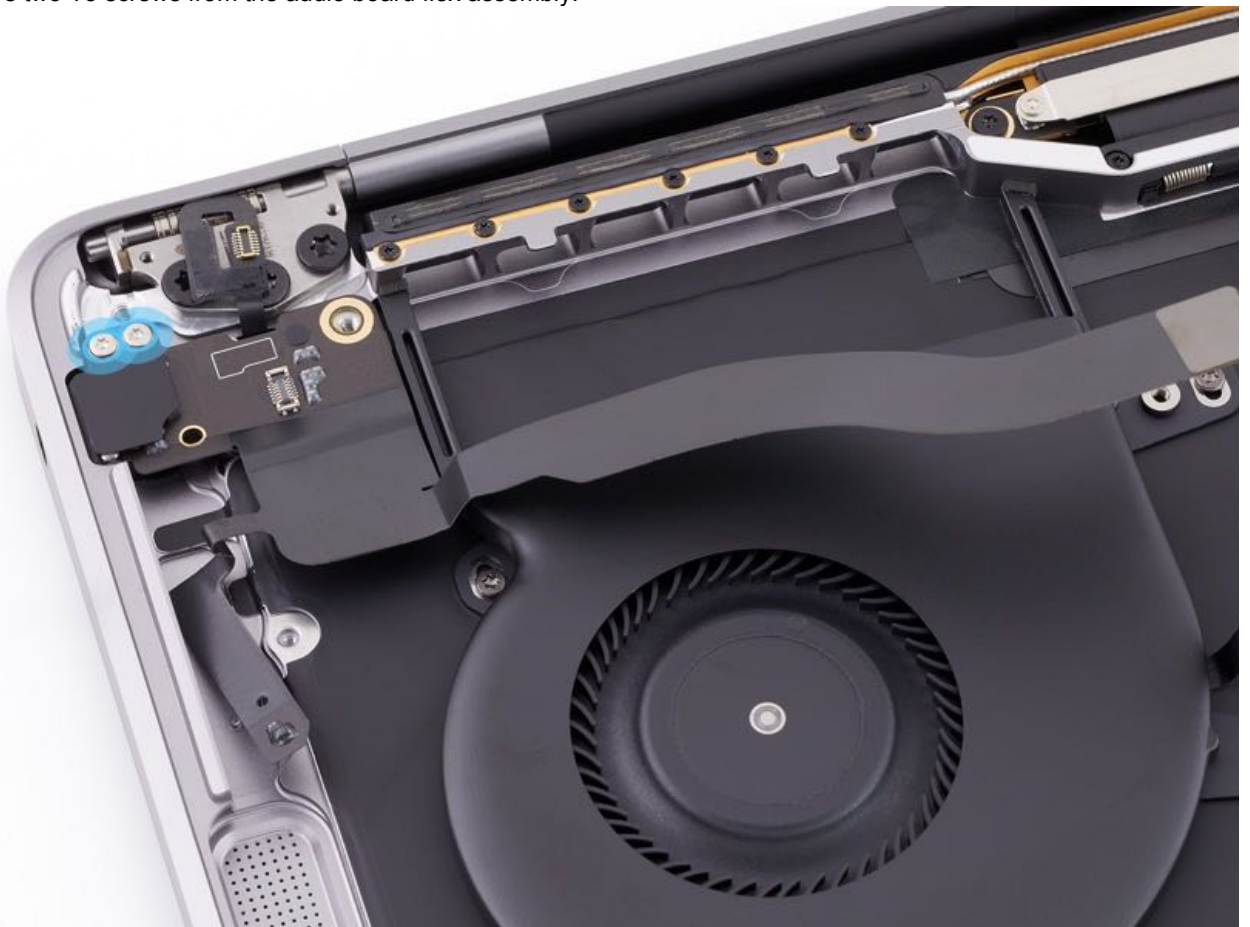
3. Disconnect the Touch ID board flex cable.



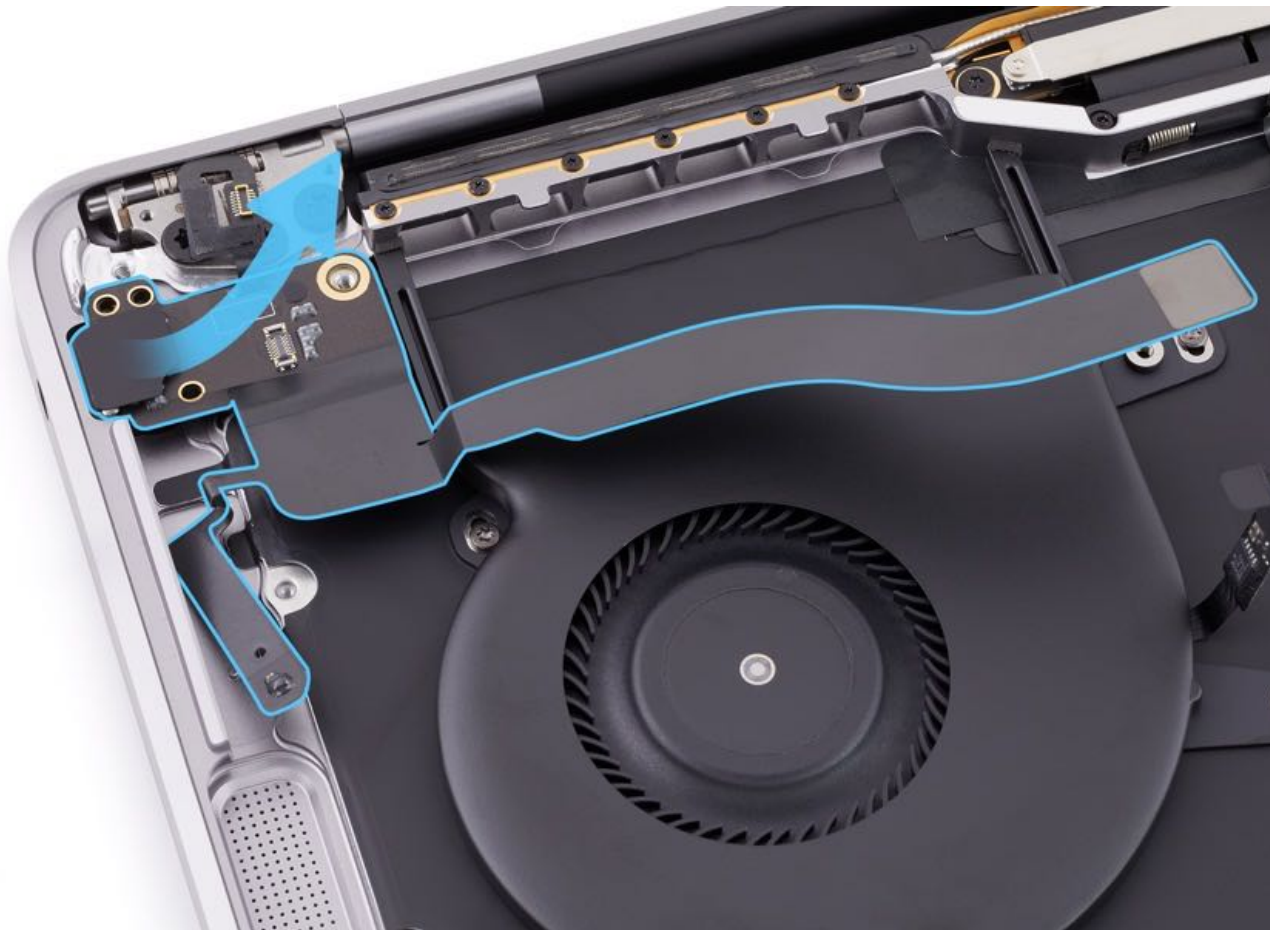
4. Use round nose tweezers to loosen the adhesive on the Touch ID board flex cable. Carefully tuck the flex cable under the edge of the top case to keep it from getting damaged during this procedure.



5. Remove two T3 screws from the audio board flex assembly.



6. Lift the audio board flex assembly out of the top case.

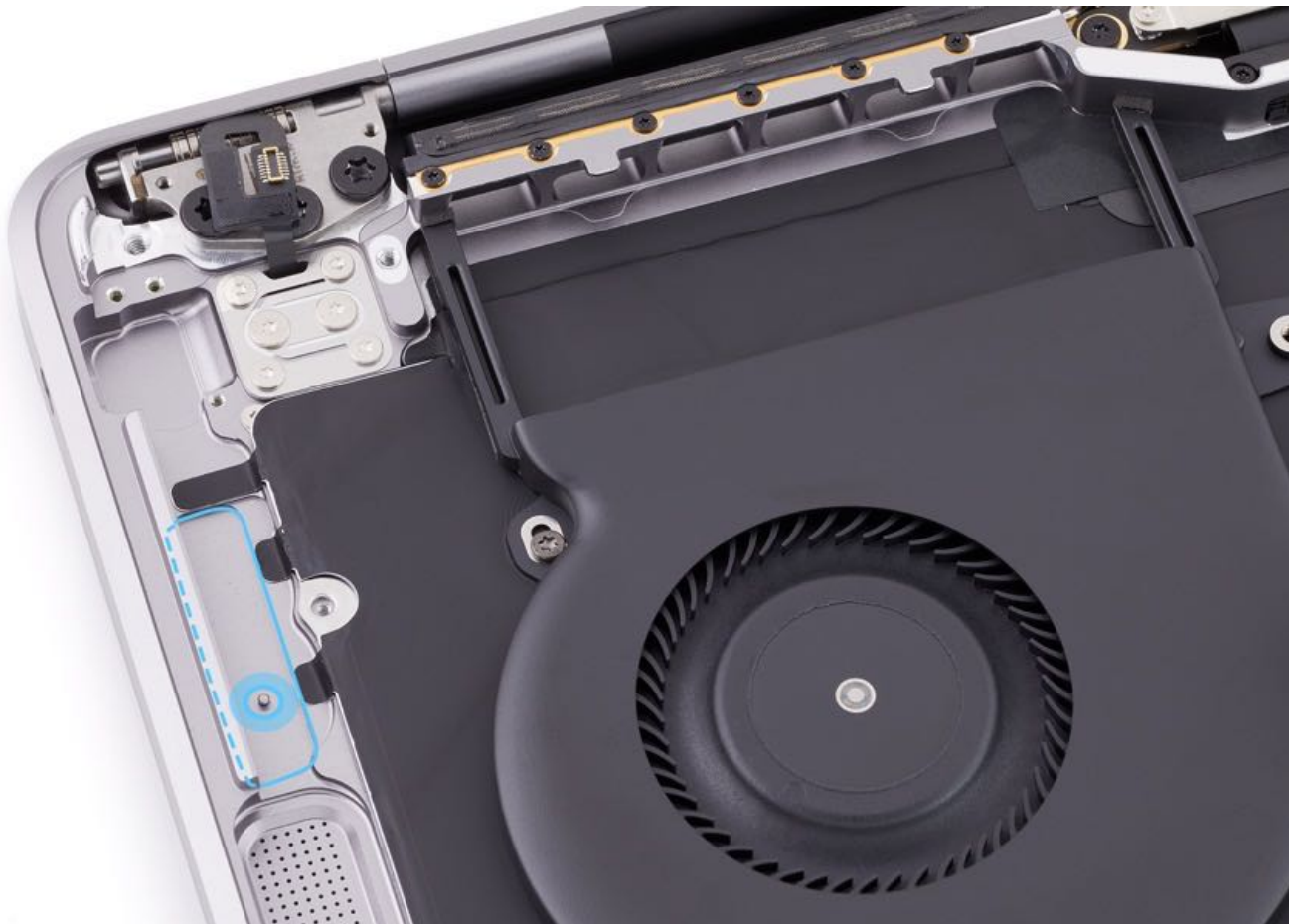


Steps For Reassembly

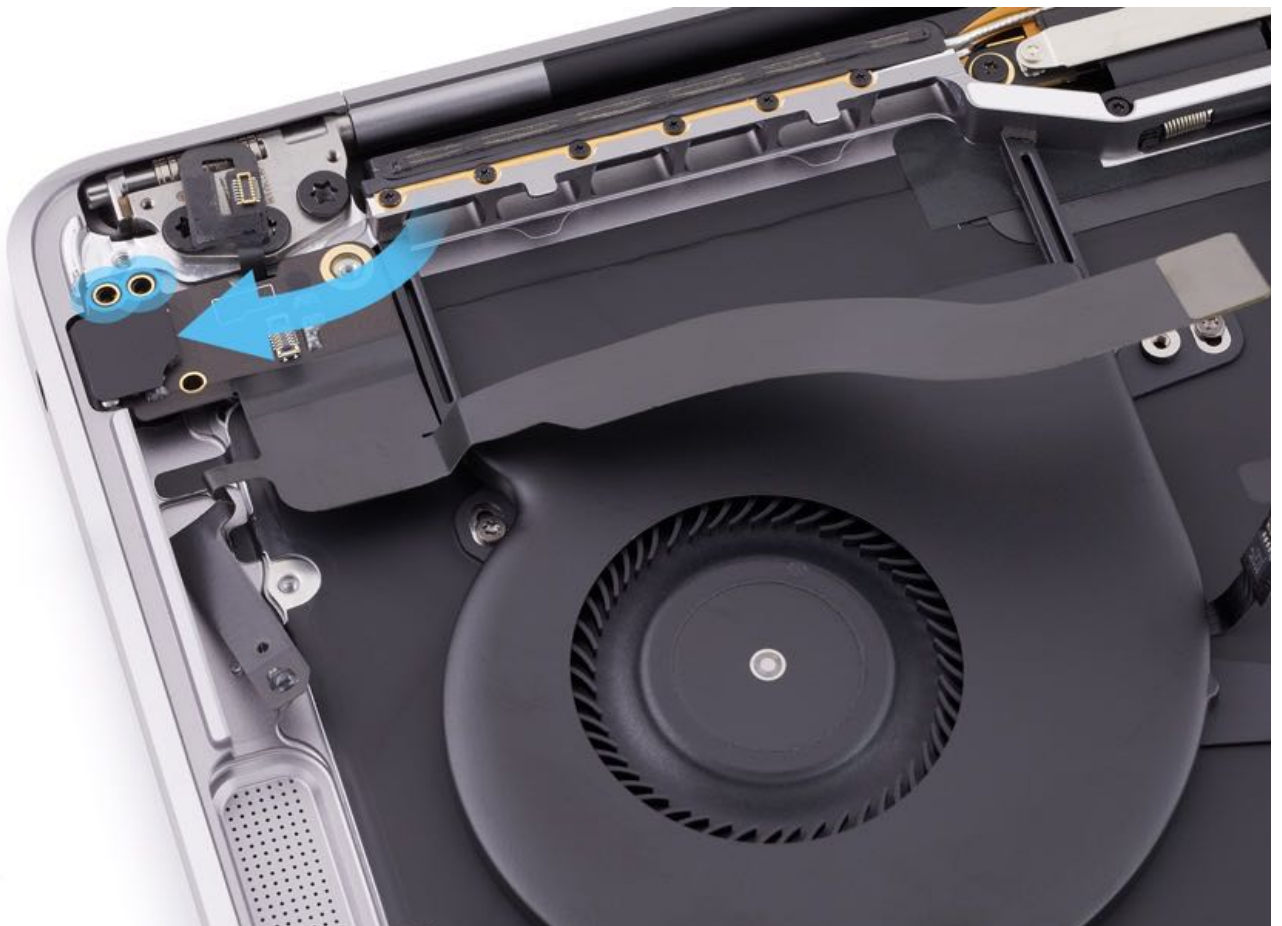


Important:

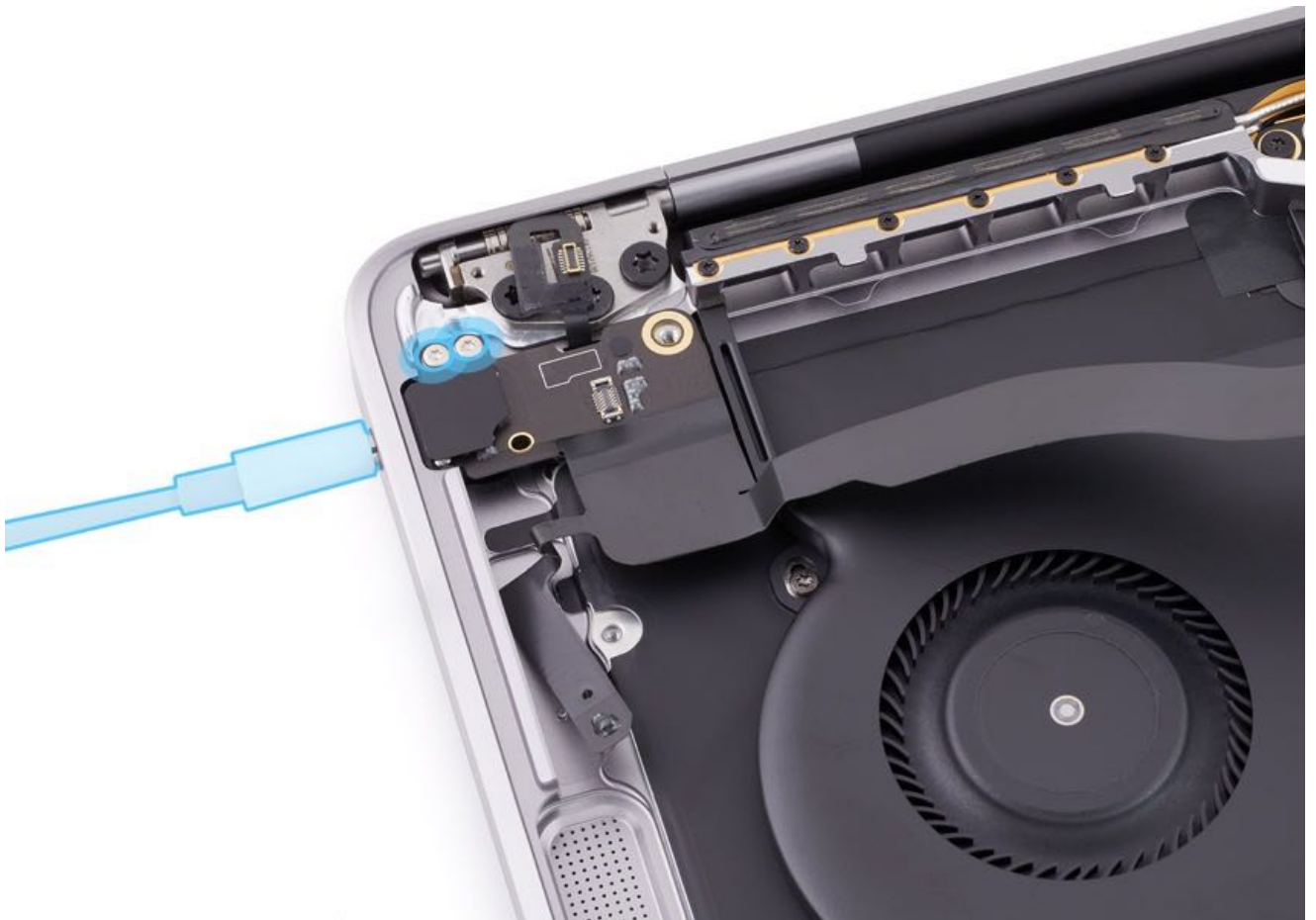
- A new audio board flex assembly must be installed every time it is removed from the top case.
 - Be sure to order the correct part when replacing the audio board flex assembly.
 - Space Gray: 923-04166
 - Silver: 923-04167
1. Clean any residual adhesive from the fan and top case with a black stick. Note the Hall effect cable alignment pin in the top case.



2. Reinstall the audio board flex assembly into the top case. Partially reinstall the two T3 screws (923-04188).



3. Plug in a 3.5 mm headphone jack to check alignment. Fully tighten the T3 screws, then remove the 3.5 mm headphone jack.



4. Replace the [Touch ID board flex cable adhesive](#). Connect the Touch ID board flex cable and readhere the flex cable to the audio board flex assembly.

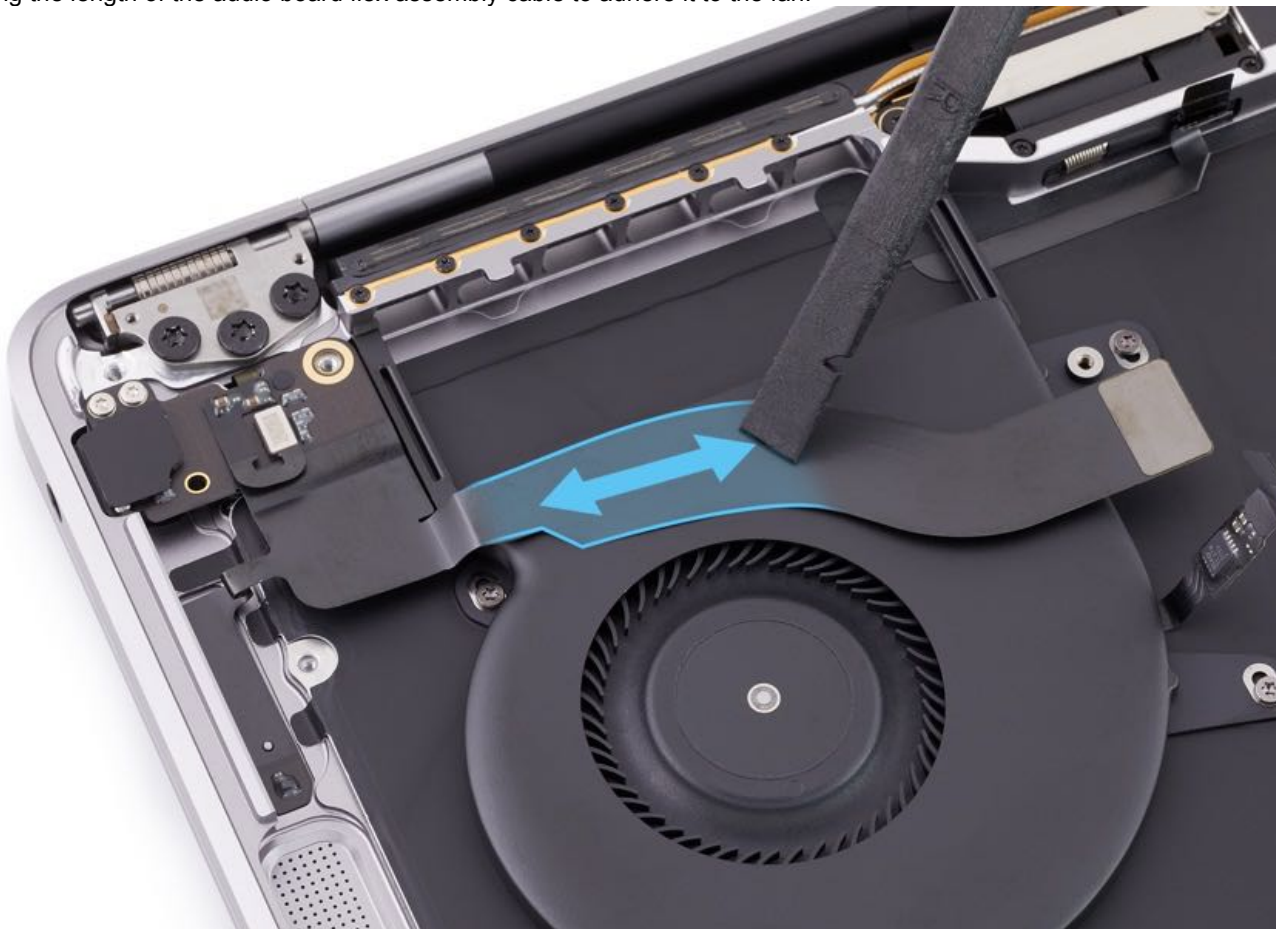


5. Peel the blue adhesive cover strip from the Hall effect sensor cable. Align the hole in the Hall effect sensor cable with the alignment pin in the top case. Gently run the flat end of a black stick along the length of the Hall effect sensor cable to adhere it to the top case.

Caution: Don't touch the Hall effect sensor. Stop at the alignment pin.



6. Peel off the blue adhesive cover strip from the audio board flex assembly cable. Gently run the flat end of a black stick along the length of the audio board flex assembly cable to adhere it to the fan.



7. Reinstall the [logic board](#).
8. Reinstall right [speaker](#).
9. Reinstall right [clutch cover](#).
10. [Reconnect the battery and remove the battery cover](#).
11. Reinstall the [bottom case](#).

Repair Completion:

12. [System Configuration](#) must be performed after a [logic board](#), [Touch ID board](#), [display](#), and [top case](#) repair.
13. Perform the [Trackpad Calibration Check](#) to verify trackpad performance after every repair.

Post Repair Verification:

14. After repair completion, verify the repair was successful by running the [required AST 2 diagnostics based on the repair module that was replaced](#) .

MacBook Pro (13-inch, 2020, Two Thunderbolt 3 Ports) Touch ID Board

First Steps



Caution:

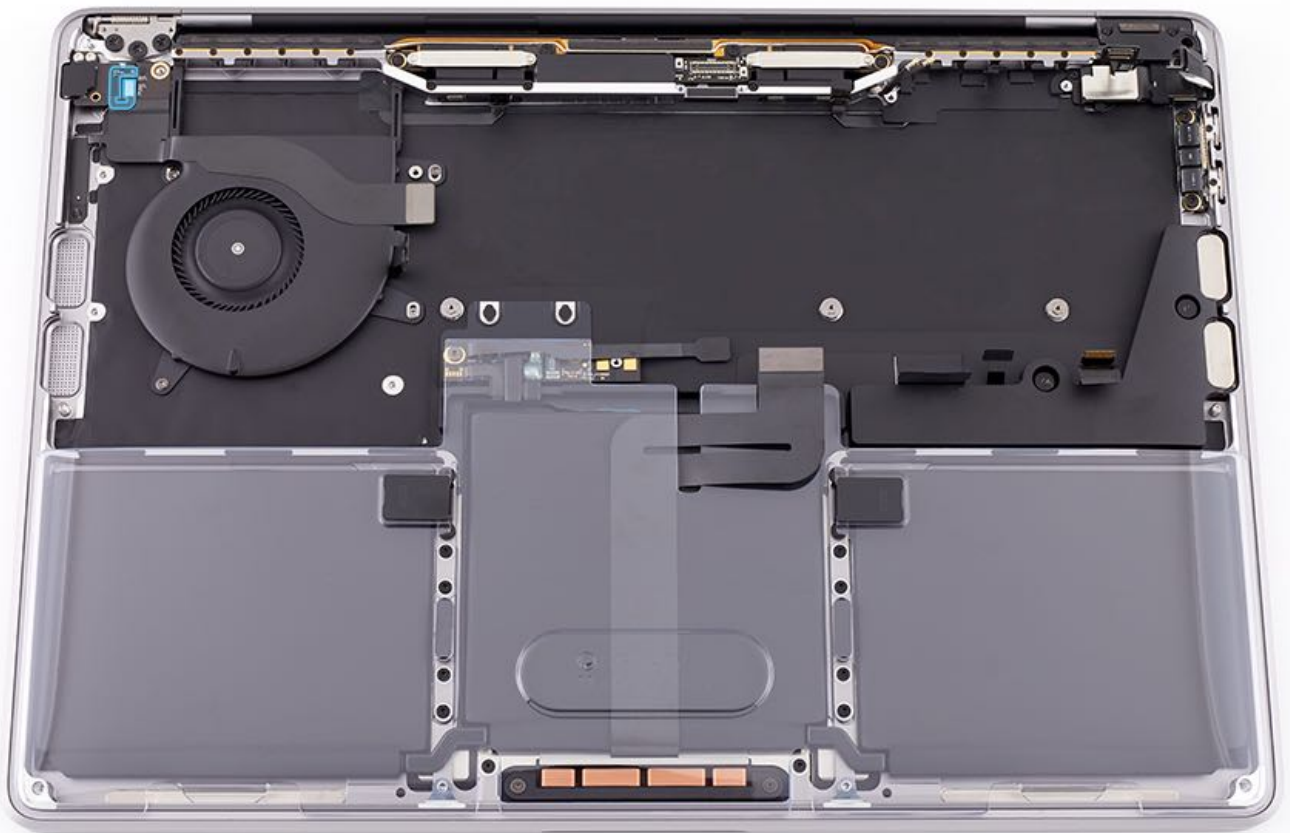
- Only [Apple-certified technicians](#) should perform this procedure.
- To avoid damaging parts, you must [attach the battery cover and disconnect the battery](#)
- Don't connect the computer to any external power source during repair.
- Wear an ESD wrist strap and take precautions to avoid ESD.

System Configuration:

- Run the [System Configuration Suite](#) If you don't run the System Configuration Suite after you replace a [logic board](#), [Touch ID board](#), [display](#), or [top case](#), the computer will be unresponsive.
- If you replace the [logic board](#), you must also replace the Touch ID board. But if you reinstall the same logic board, you don't need to replace the Touch ID board.

Remove:

- [Bottom Case](#)
- [Attach the Battery Cover and Disconnect the Battery](#)
- [Logic Board](#)
- [Clutch Covers](#) (right only)
- [Speakers](#) (right only)



Tools

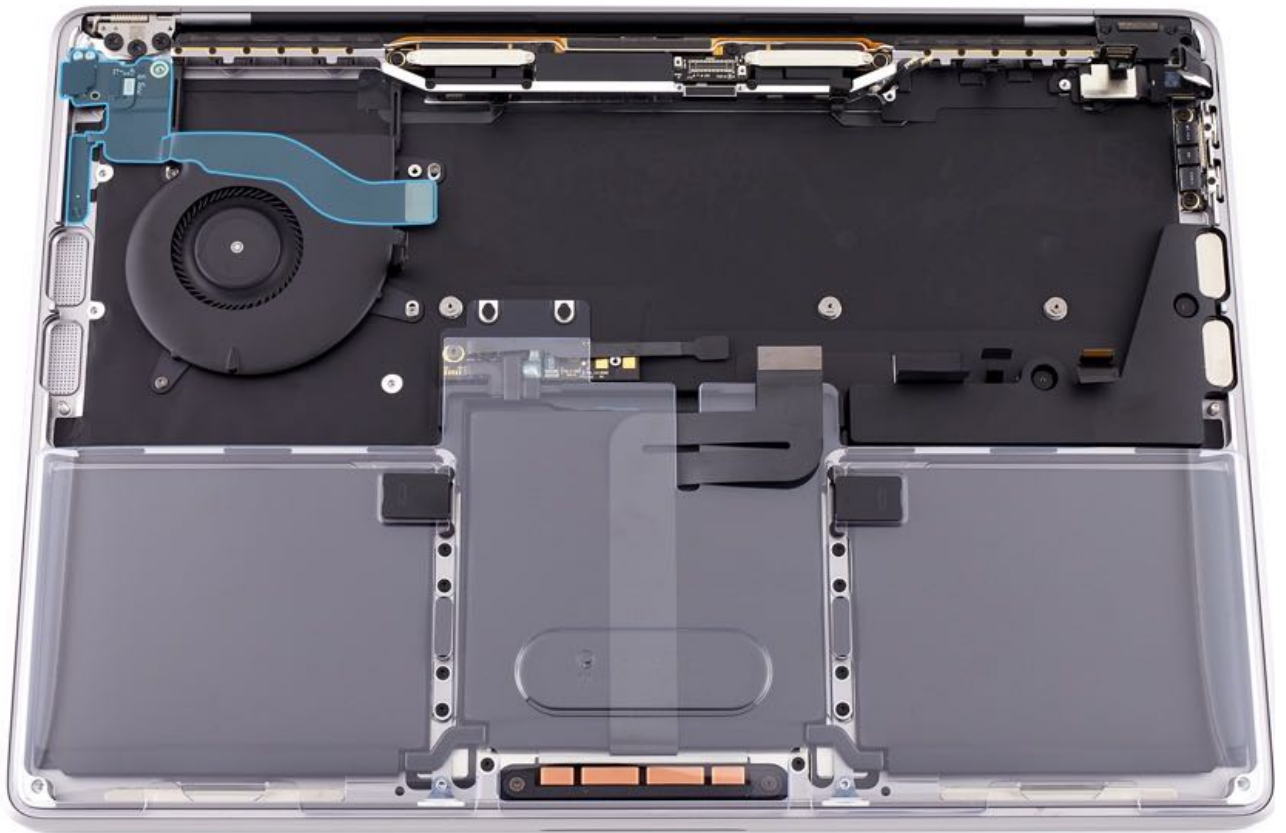
1. Touch ID alignment kit (923-03032)
2. Torx T3 screwdriver
3. Black stick

4. ESD-safe tweezers
5. Kapton tape

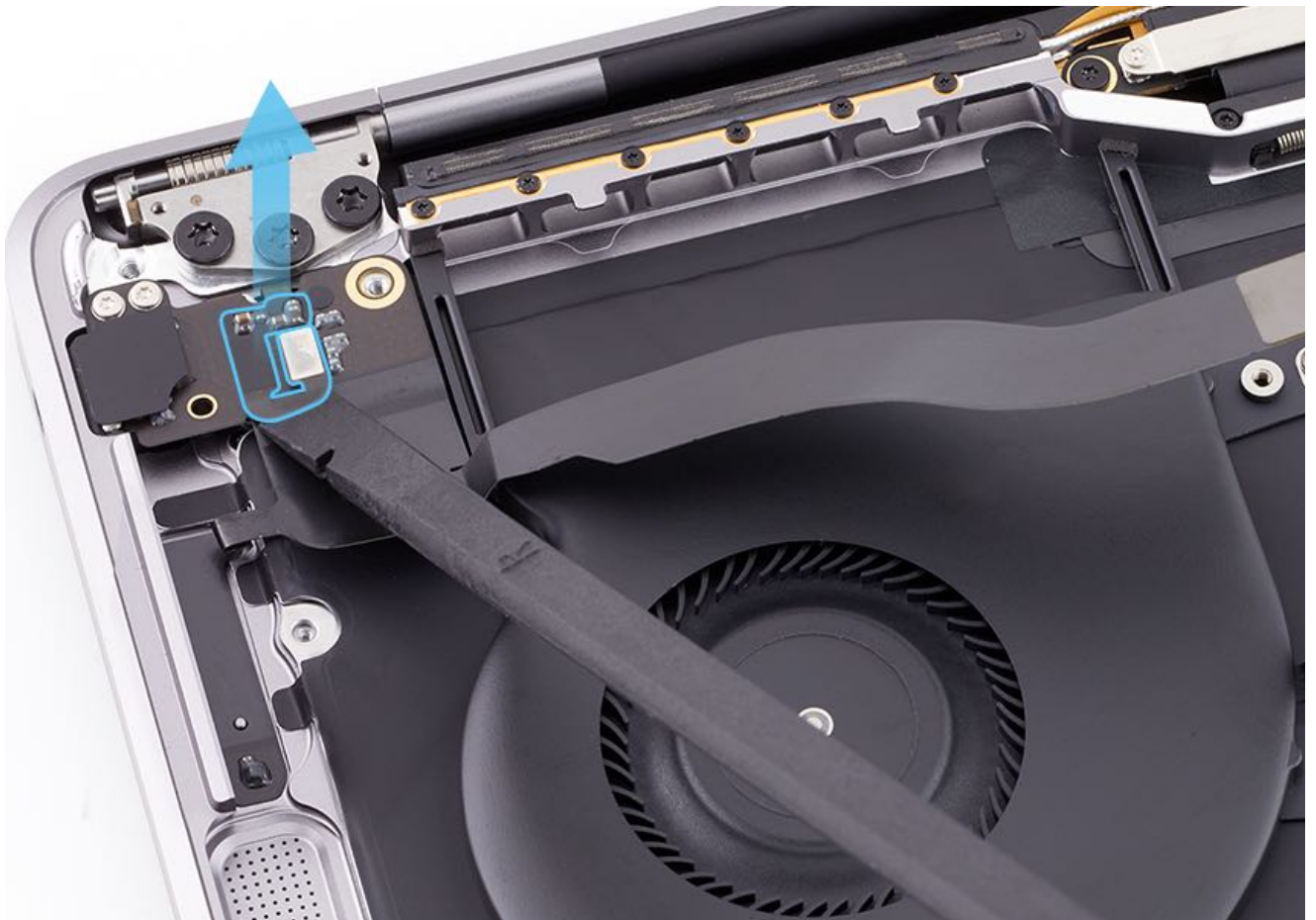


Steps For Removal

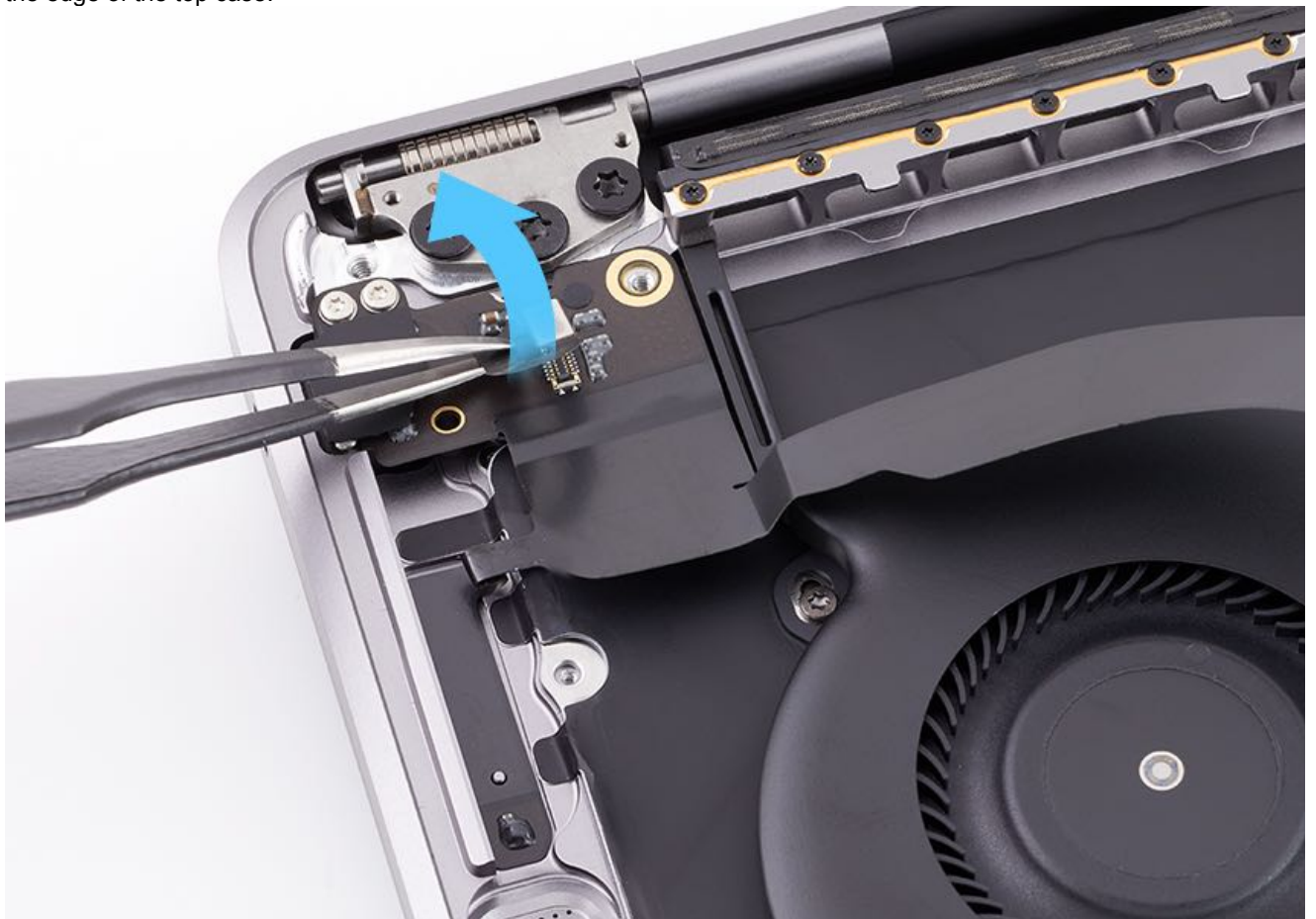
1. To access the Touch ID board, you must partially remove the audio board flex assembly as shown in steps 2 through 5.



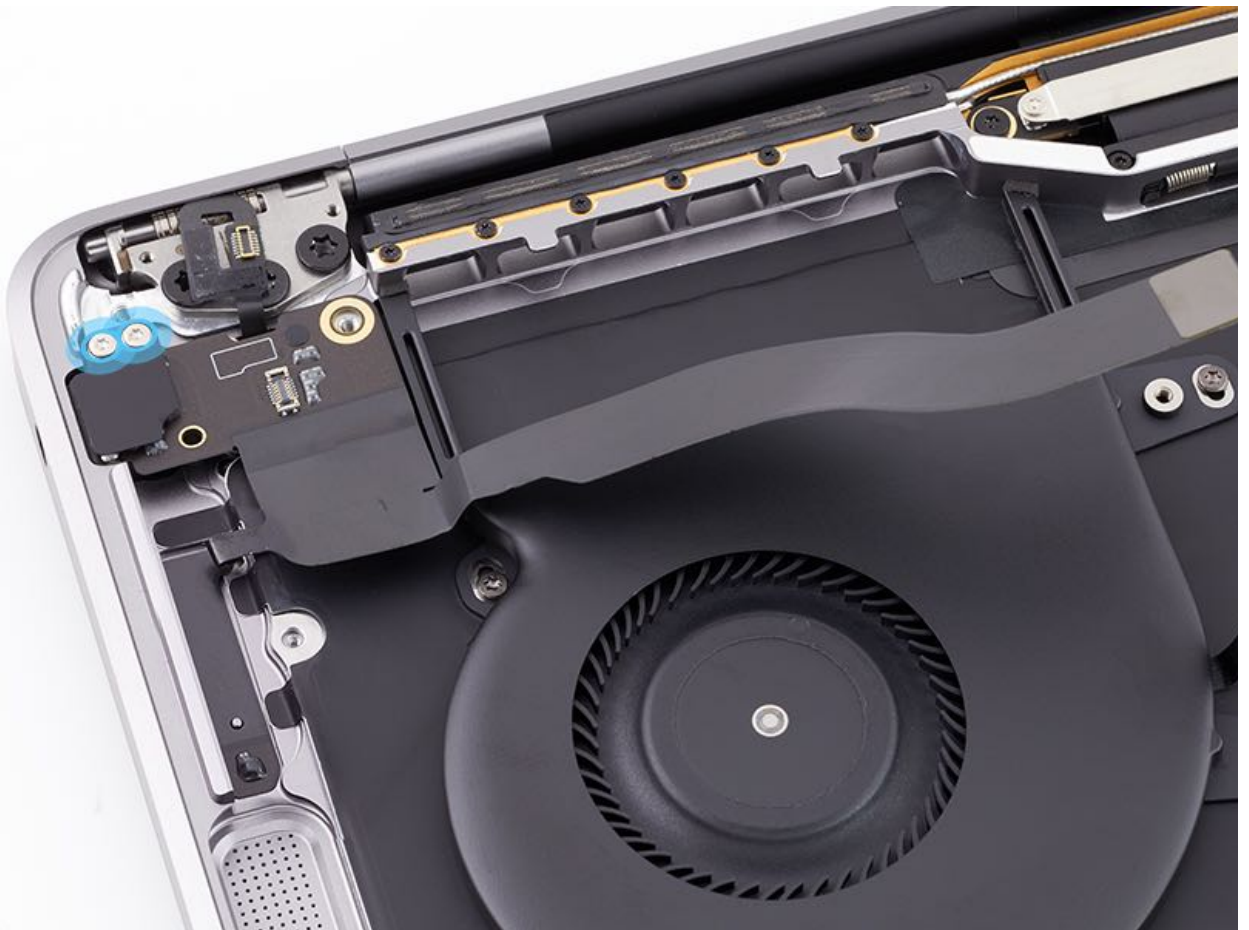
2. Disconnect the Touch ID board flex cable from the audio board flex assembly.



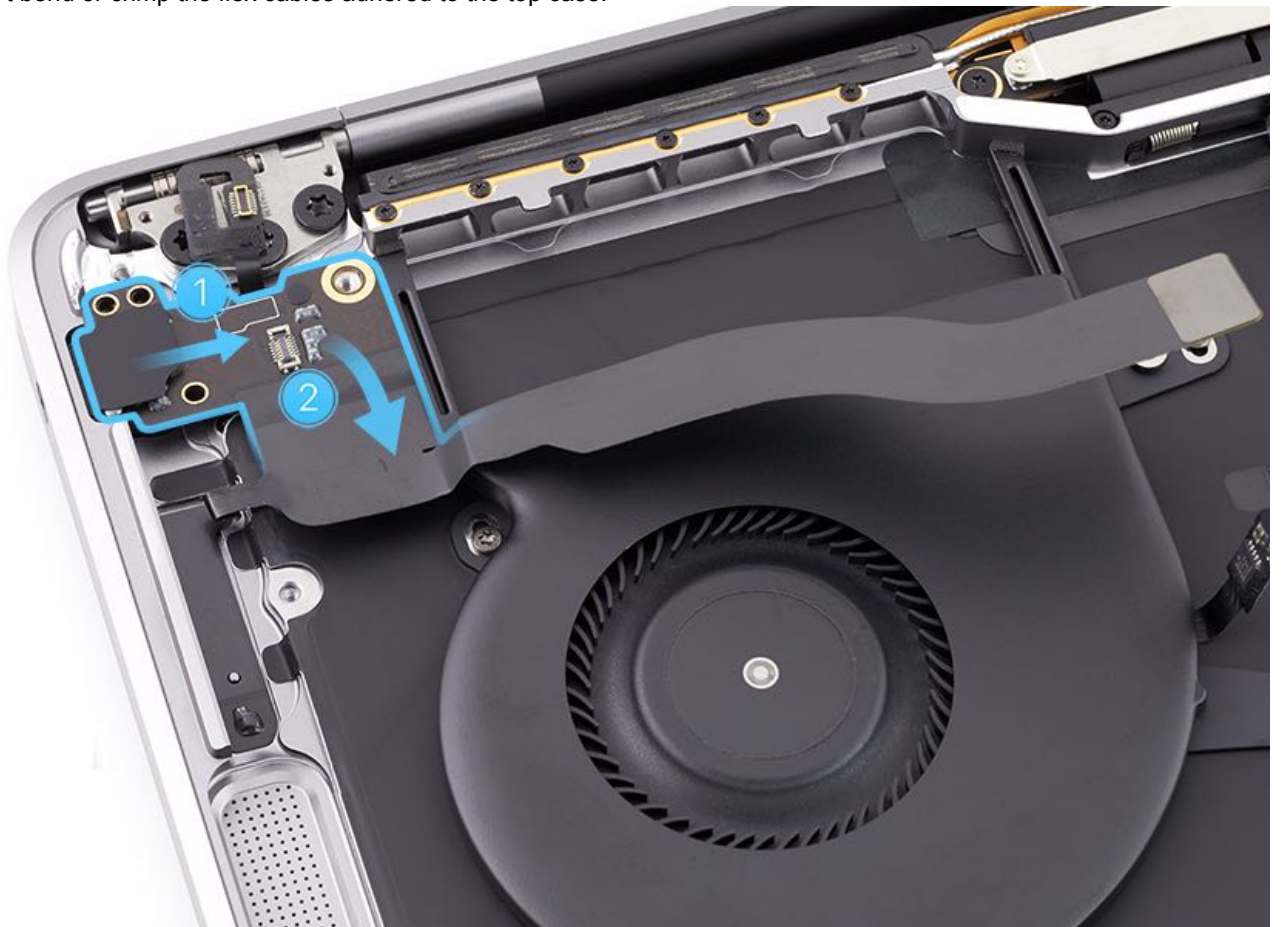
3. Use ESD-safe tweezers to loosen the adhesive on the Touch ID board flex cable. Carefully tuck the flex cable under the edge of the top case.



4. Remove two T3 screws from the audio board flex assembly.



5. Lift the audio board flex assembly out of the top case just enough to access the Touch ID board flexure and screws. Don't bend or crimp the flex cables adhered to the top case.



6. Remove six T3 screws from the Touch ID board flexure.



7. Use ESD-safe tweezers to remove the Touch ID board flexure from the top case.



8. Open the display and stand the computer on its side. With a hand on each side of the top case, support the Touch ID board as you thread the flex cable through the slot. Remove the Touch ID board from the keyboard side of the top case.



Steps For Reassembly

Note: If you are installing a replacement Touch ID board, remove the protective film from the glass surface.



1. Place the computer flat on the ESD mat. Set two Y-shaped alignment tools in the Touch ID opening as shown. Secure the alignment tools with Kapton tape.

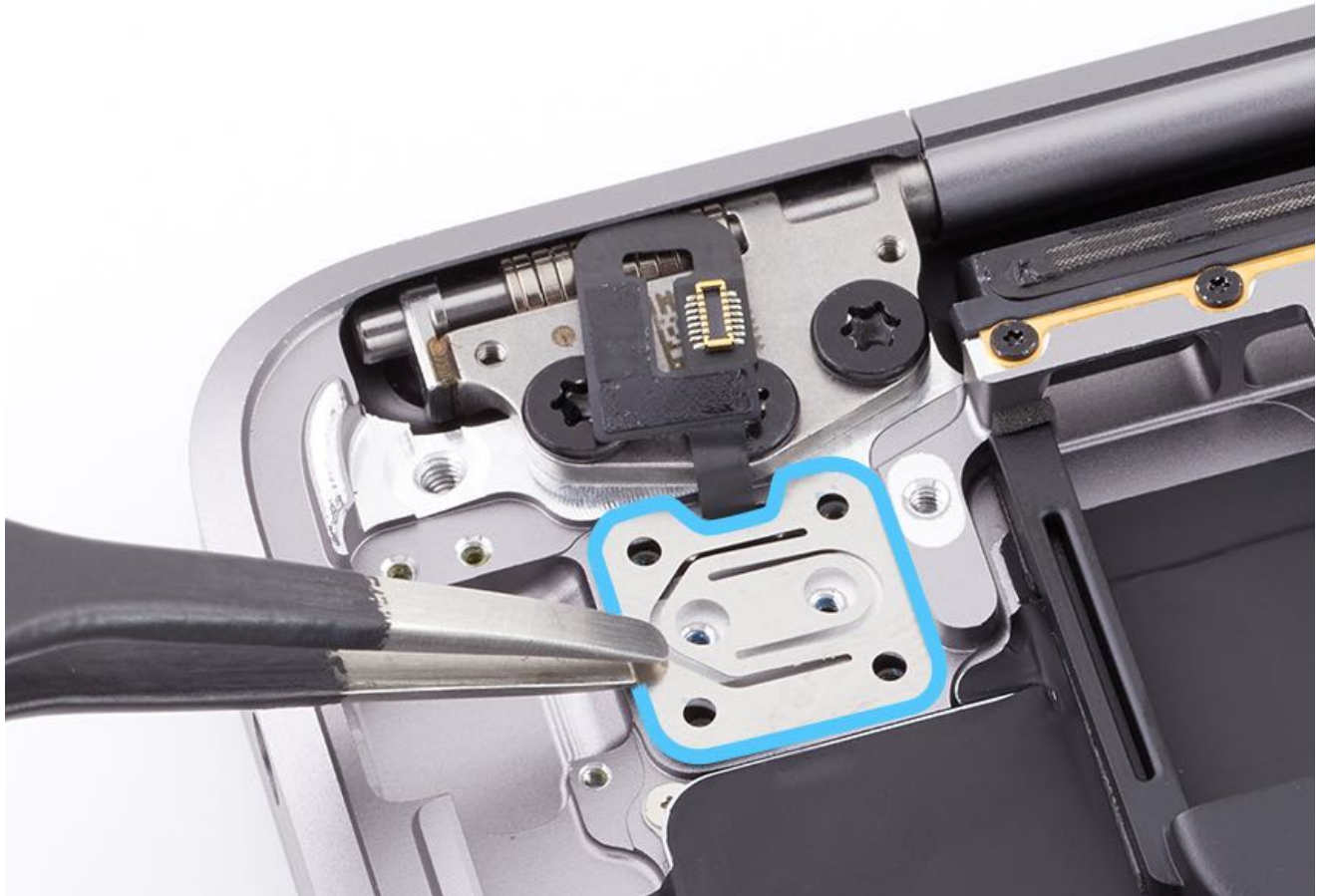
Caution: Don't damage parts in the top case that aren't fully installed.



2. Open the display and stand the computer on its side. Thread the Touch ID board flex cable through the opening in the top case.



3. Use ESD-safe tweezers to reinstall the Touch ID board flexure.
Important: Ensure that it's installed in the correct orientation or the button may not function properly.



4. Hold the Touch ID board flexure in place while reinstalling the four outer T3 screws (1). Then partially reinstall the two middle T3 screws (2).

Note: Screw color may vary.

1. 923-03910 (outer)



2. 923-03911 (middle)





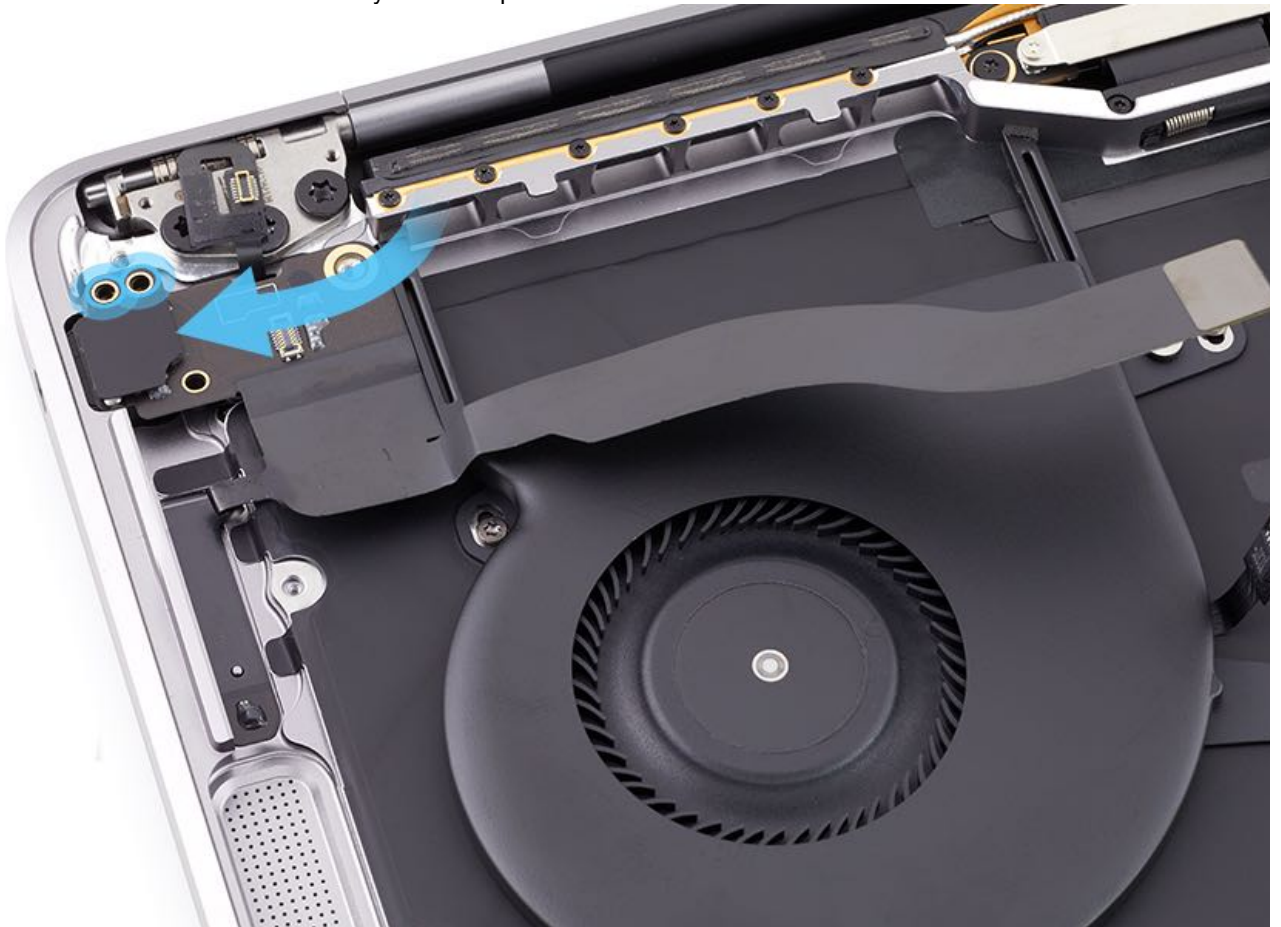
5. Press the Touch ID button to verify that it makes a clicking noise. Fully tighten the two middle screws while continuing to verify that the Touch ID button makes a clicking noise when pressed. If the button doesn't move at all or moves but doesn't click, you may need to install a [Touch ID shim](#).



6. Remove the Y-shaped alignment tools and look at the Touch ID button to verify that all the sides are spaced equally. If not, restart the alignment process with step 1.

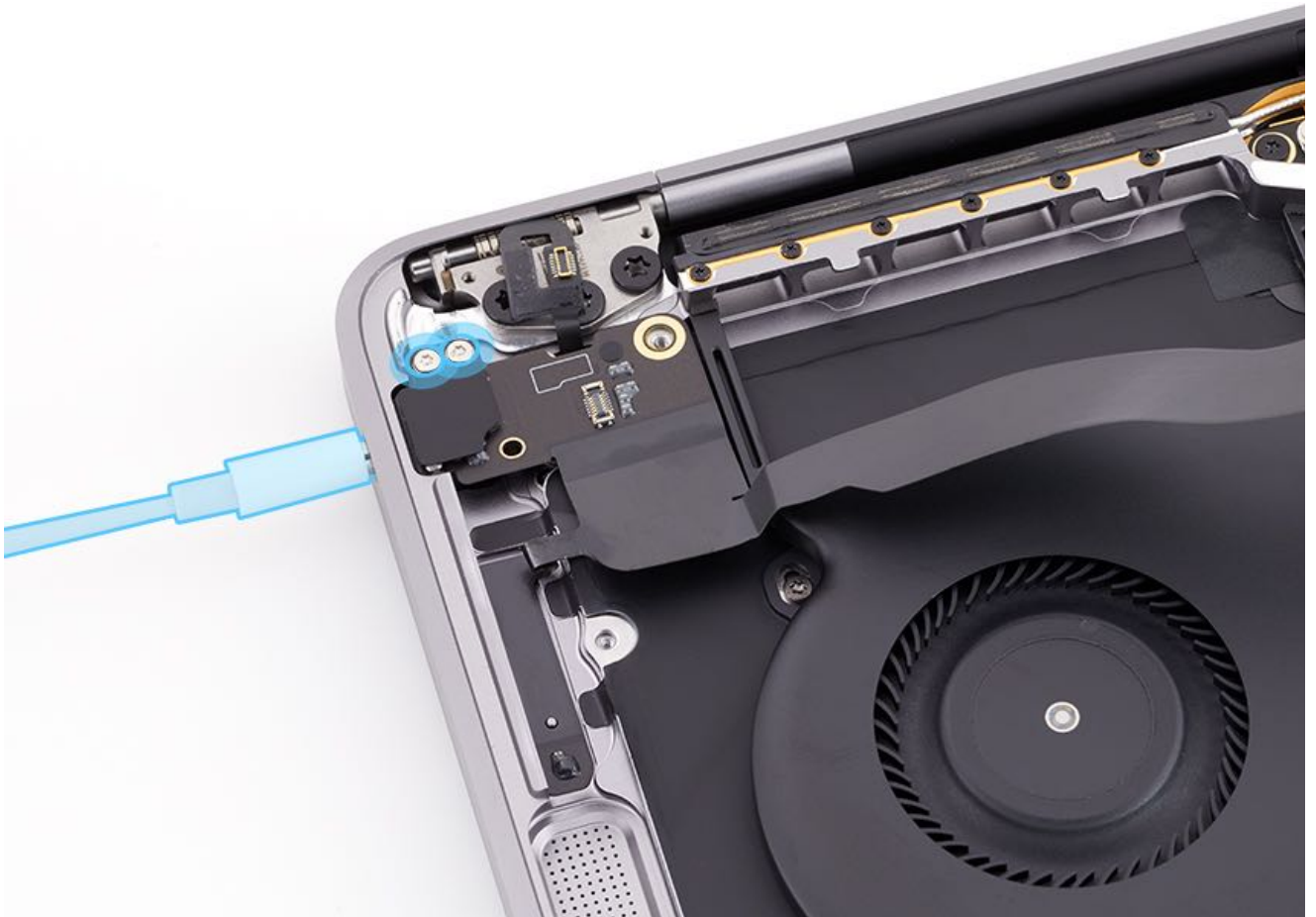


7. Reinstall the audio board flex assembly into the top case.



8. Partially reinstall the two T3 screws (923-04188). Plug in a 3.5 mm headphone jack to check alignment. Then fully tighten the T3 screws and remove the 3.5 mm headphone jack.





9. Replace the [Touch ID board flex cable adhesive](#). Connect the Touch ID board flex cable and adhere the flex cable to the audio board flex assembly.



10. Reinstall the [logic board](#).
11. Reinstall the [right clutch cover](#).
12. [Reconnect the battery and remove the battery cover](#).
13. Reinstall the [bottom case](#).

Repair Completion:

14. Run the [System Configuration Suite](#)

Caution: If you don't run the System Configuration Suite after you replace a [logic board](#), [Touch ID board](#), [display](#), or [top case](#), the computer will be unresponsive.

15. Run the [Trackpad Calibration Check](#) .

Post Repair Verification:

16. Run the [required AST 2 diagnostics for the parts that you replaced](#) .

Touch ID Shim

First Steps



Warning:

- To avoid damaging parts, you must install the battery cover and either disconnect the battery or disengage battery power to the logic board.
- Don't connect the computer to any external power source during repair.

Important:

- Only [Apple-certified technicians](#) should perform this procedure.
- Wear an ESD wrist strap and take precautions to avoid ESD.
- The Touch ID alignment kit and replacement Touch ID shims are included in part boxes when Touch ID reinstallation or replacement is necessary. Learn how and when to use these parts in Touch ID reassembly steps.

Note: The images shown are of MacBook Pro (13-inch, 2016, Four Thunderbolt 3 Ports), but the process is the same for MacBook Air (Retina, 13-inch, 2018, 2019, and 2020), MacBook Pro (13-inch, 2019 and 2020, Two Thunderbolt 3 Ports), and MacBook Pro (13-inch, 2017, 2018, 2019, 2020, Four Thunderbolt 3 Ports).



Tools

- Torx T3 screwdriver (magnetized)
- ESD-safe tweezers
- Shim kit, package of 3 (923-01519), not shown



Steps For Removal

Note: The Touch ID shim is a tiny, circular part. Ensure that your work surface is completely clean. A clean surface allows easy location of the shim if it falls on the ESD mat during repair.

1. Determine the required Touch ID shim size:

- If the button feels too loose or doesn't click, a larger shim is required.
- If the button feels too stiff or doesn't move, a smaller shim is required.



2. Spread the tips of the ESD-safe tweezers, and use one tip to push the shim out.



3. Retrieve the loose shim on the keyboard side of the top case. The shim has a small amount of adhesive and may stick to the top case. The shim is black on the adhesive side and silver on the opposite side.



Steps For Reassembly

1. Replace the Touch ID shim with one of the shims from the kit (923-01519). Shims are marked and organized by size.
 - Use ESD-safe tweezers to remove the appropriate shim from the backing.
 - Hold less than half of the shim with the ESD-safe tweezer for easier installation.
2. Set the computer flat on the ESD mat.

Important: For MacBook Pro models, ensure that the battery cover is in position and the I/O board(s) are flat.

3. Align the shim in the recessed circle on the top case.



4. Gently press the shim to activate the adhesive.



5. Reinstall the Touch ID board for the model you're repairing:

- [MacBook Air \(Retina, 13-inch, 2020\)](#)
- [MacBook Air \(Retina, 13-inch, 2018 and 2019\)](#)
- [MacBook Pro \(13-inch, 2020, Two Thunderbolt 3 Ports\)](#)

- [MacBook Pro \(13-inch, 2019, Two Thunderbolt 3 Ports\)](#)
- [MacBook Pro \(13-inch, 2020, Four Thunderbolt 3 Ports\)](#)
- [MacBook Pro \(13-inch, 2016, 2017, 2018, 2019, Four Thunderbolt 3 Ports\)](#)

Note: Confirm that Touch ID and the power button function correctly with the new shim installed.

6. Run the [Trackpad Calibration Check](#) .

MacBook Pro (13-inch, 2020, Two Thunderbolt 3 Ports) Touch ID Board Flex Cable Adhesive

First Steps



Caution:

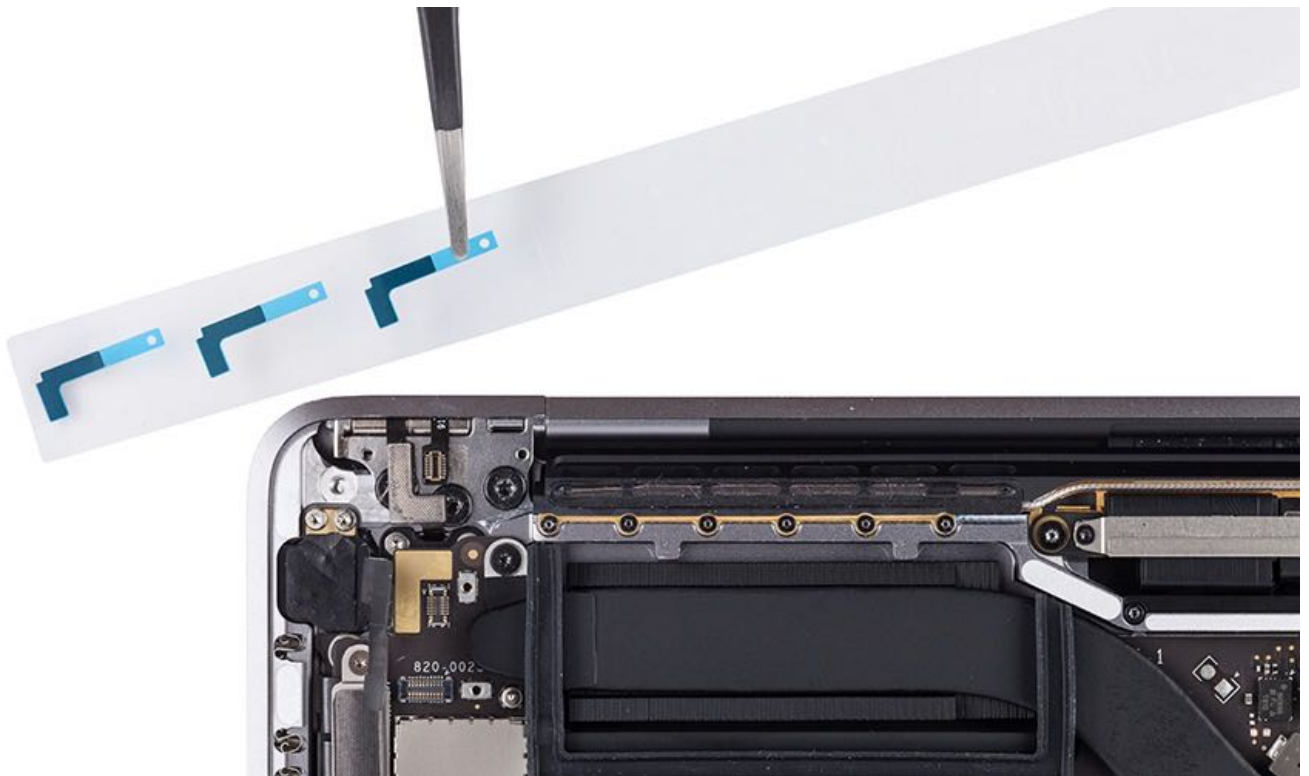
- Only [Apple-certified technicians](#) should perform this procedure.
- To avoid damaging parts, ensure that you have [attached the battery cover and disconnected the battery](#). Do not apply external power while the computer is under repair.
- Wear an ESD wrist strap and take precautions to avoid ESD.

Important:

- New adhesive must be applied whenever the Touch ID board flex cable is disconnected.

Note:

- The images are of a different MacBook Pro model, however the procedure is the same for MacBook Pro (13-inch, 2020, Two Thunderbolt 3 Ports).



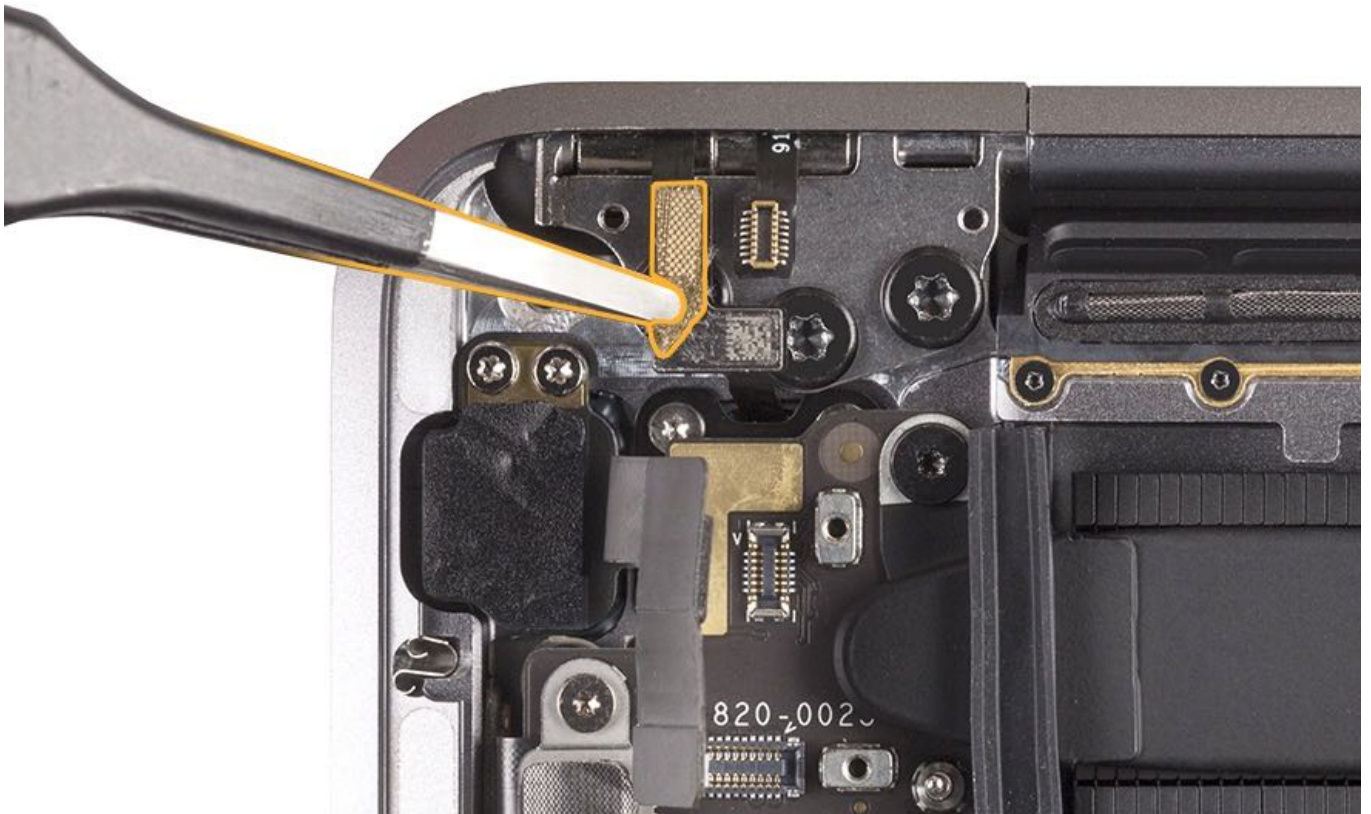
Tools

1. Black stick
2. Torx T3 screwdriver
3. ESD-safe tweezers
4. Isopropyl alcohol (IPA) wipe

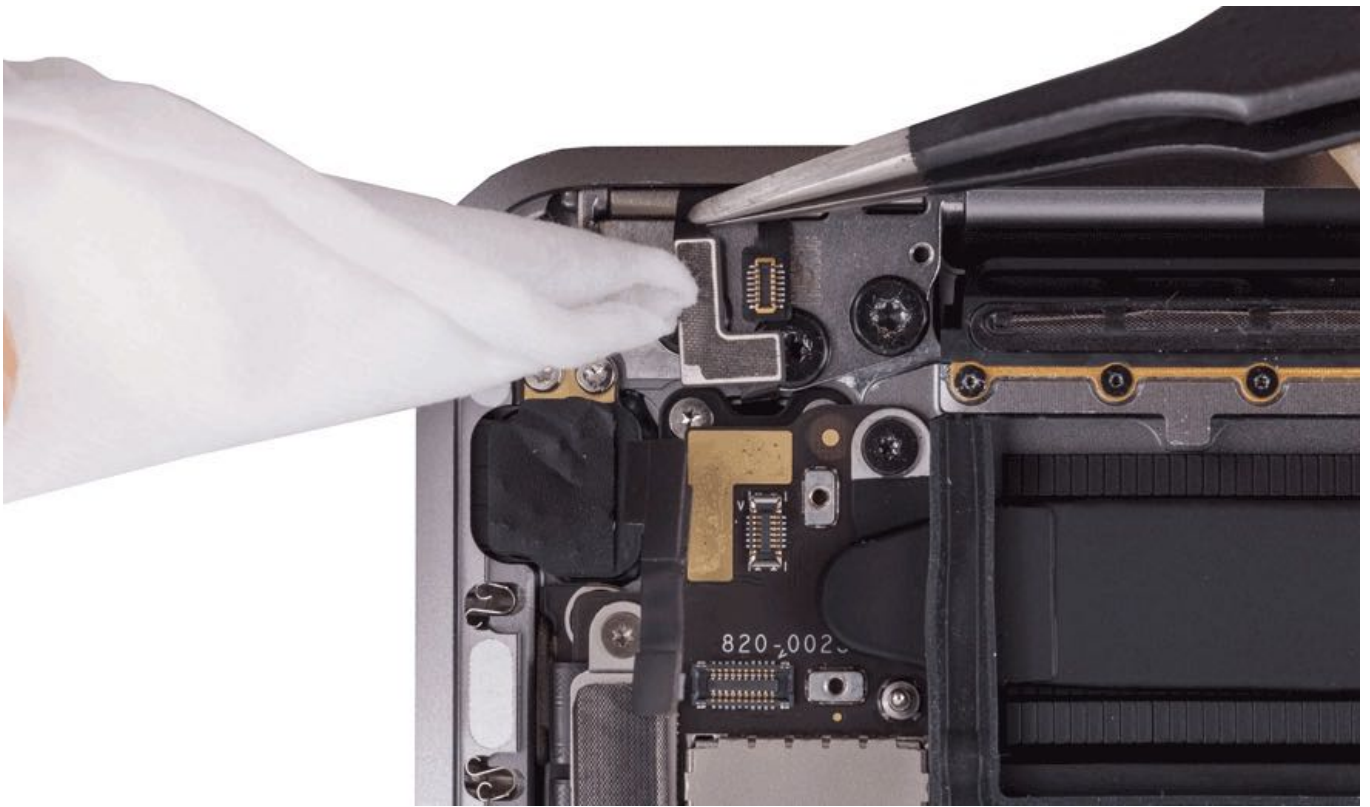


Steps For Removal

1. Use the tweezers to gently roll and pick up an end of the woven adhesive. Peel and discard the used adhesive.

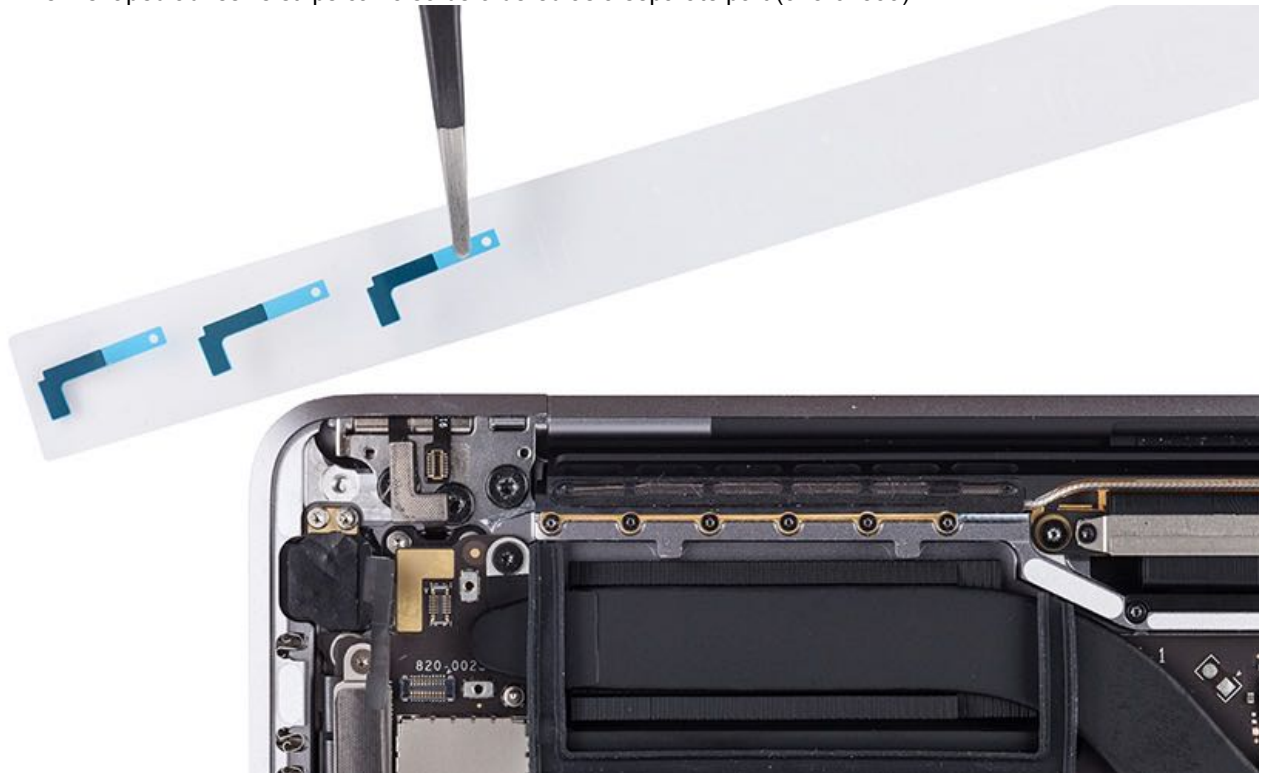


2. Support the flex cable while gently wiping away any remaining adhesive with an IPA wipe.

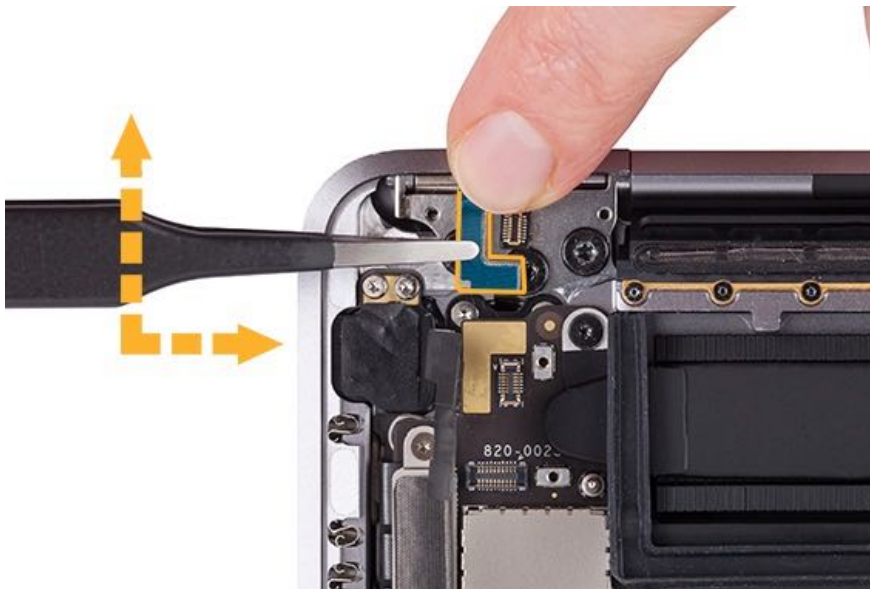


Steps For Reassembly

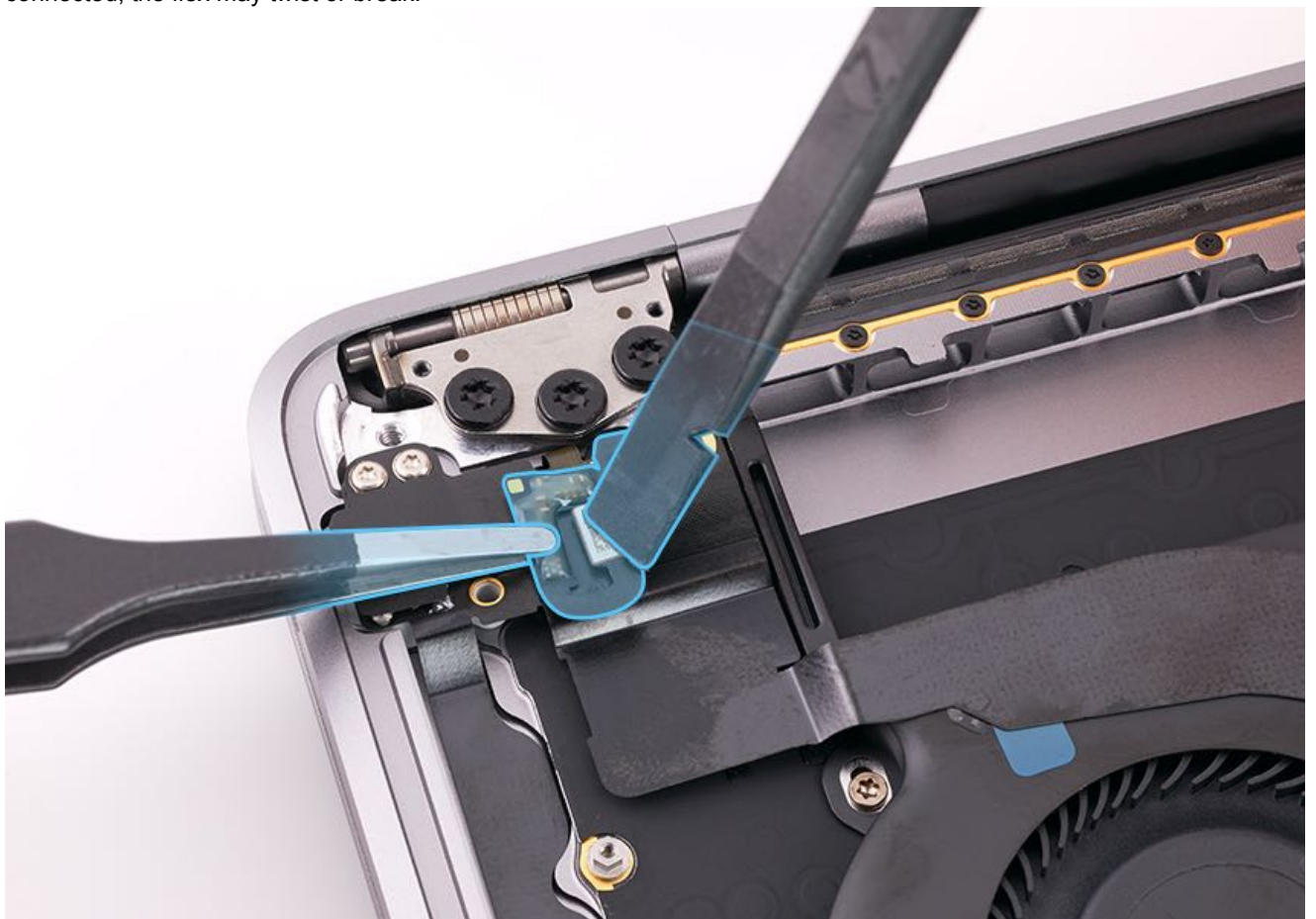
1. Peel off one of the L-shaped adhesive strips that came with a replacement audio board flex assembly or Touch ID board. Grasp the light blue (nonsticky) end and remove the strip from the sheet.
Note: The L-shaped adhesive strips can also be ordered as a separate part (923-01599).



2. Align the L-shaped adhesive within the edges of the Touch ID board flex cable. Avoid crooked or overlapping adhesive. If it is off center, peel the adhesive back and realign it on the cable. Then use the tweezers or the black stick to apply light pressure to the adhesive while rubbing it into place.



3. Slightly lift the Touch ID flex cable with tweezers to avoid the adhesive from sticking before the flex is connected. Use a black stick to reconnect the flex cable and then readhere the adhesive. If the adhesive sticks before the flex is connected, the flex may twist or break.



4. Align the flex cable over the L-shaped imprint on the audio board flex assembly.
Important: After reconnecting the Touch ID board flex cable, firmly press and hold the L-shaped section of the flex cable for 10 seconds.

Repair Completion:

5. [System Configuration](#) must be performed after a [logic board](#), [Touch ID board](#), [display](#), and [top case](#) repair.
6. Perform the [Trackpad Calibration Check](#) to verify trackpad performance after every repair.

Post Repair Verification:

7. After repair completion, verify the repair was successful by running the [required AST 2 diagnostics based on the repair module that was replaced](#).

MacBook Pro (13-inch, 2020, Two Thunderbolt 3 Ports) Fan

First Steps

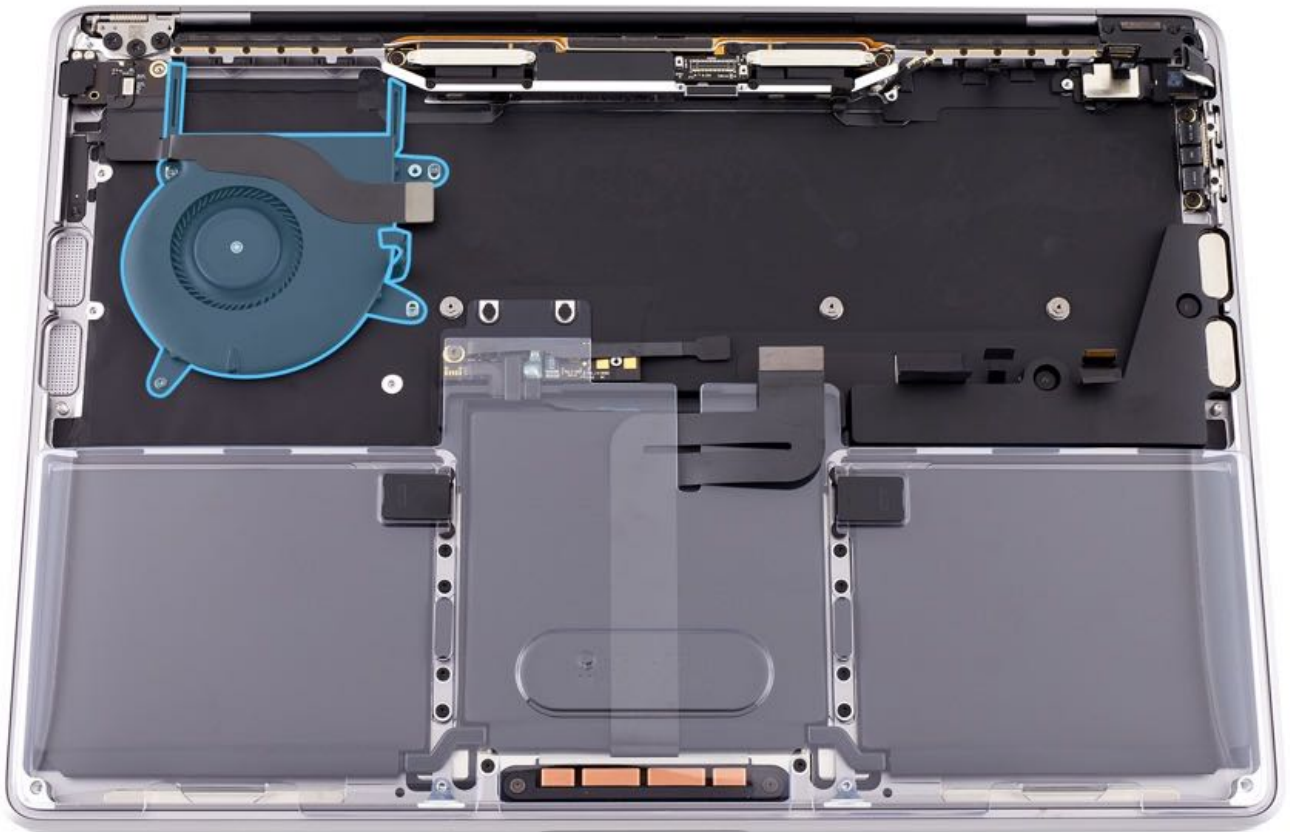


Caution:

- Only [Apple-certified technicians](#) should perform this procedure.
- To avoid damaging parts, ensure that you have [attached the battery cover and disconnected the battery](#) . Do not
- apply external power while the computer is under repair.
- Wear an ESD wrist strap and take precautions to avoid ESD.

Remove:

- [Bottom Case](#)
- [Attach the Battery Cover and Disconnect the Battery](#)
- [Logic Board](#)
- [Speaker](#) (right only)



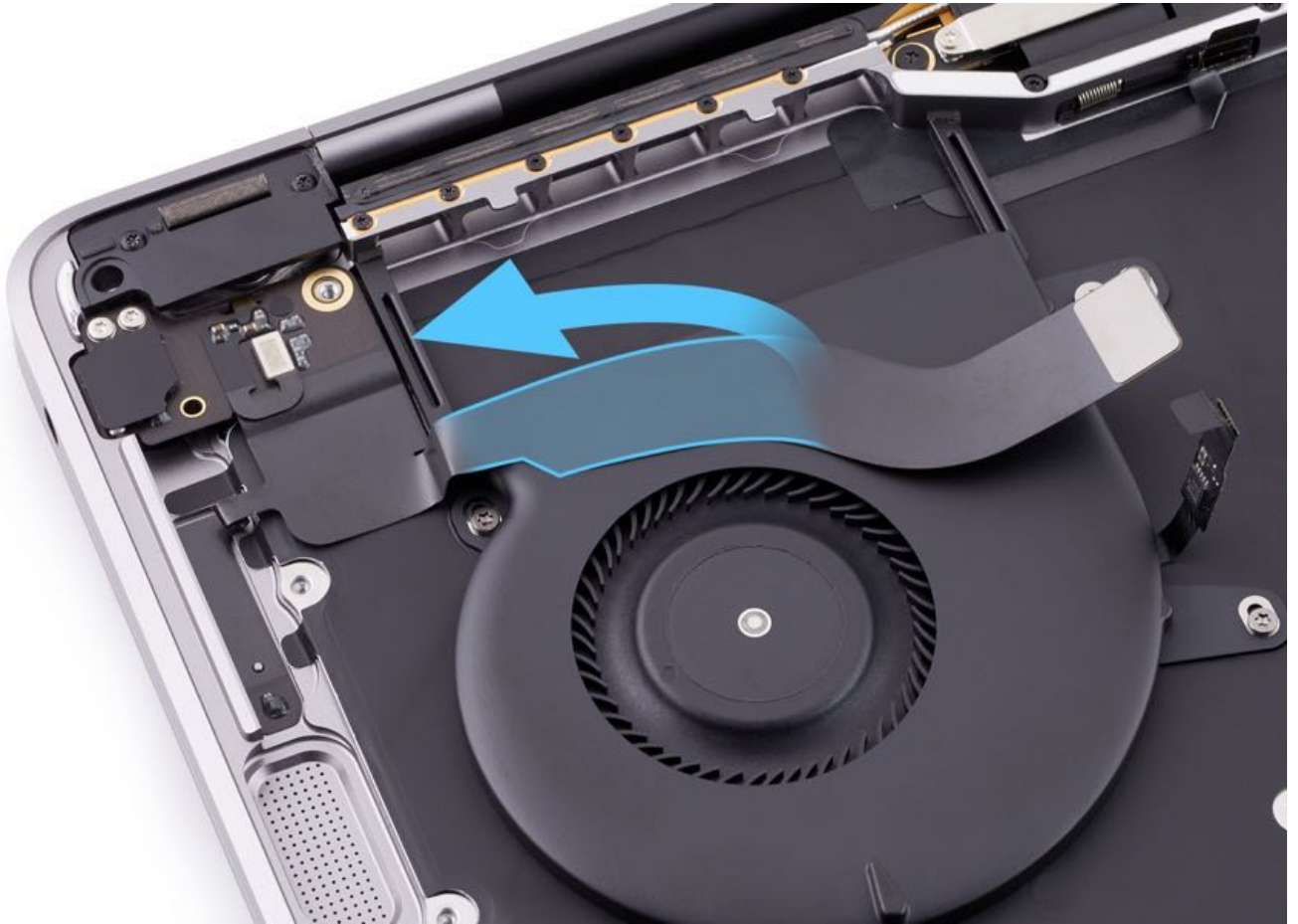
Tools

1. Torx T5 screwdriver
2. Black stick



Steps For Removal

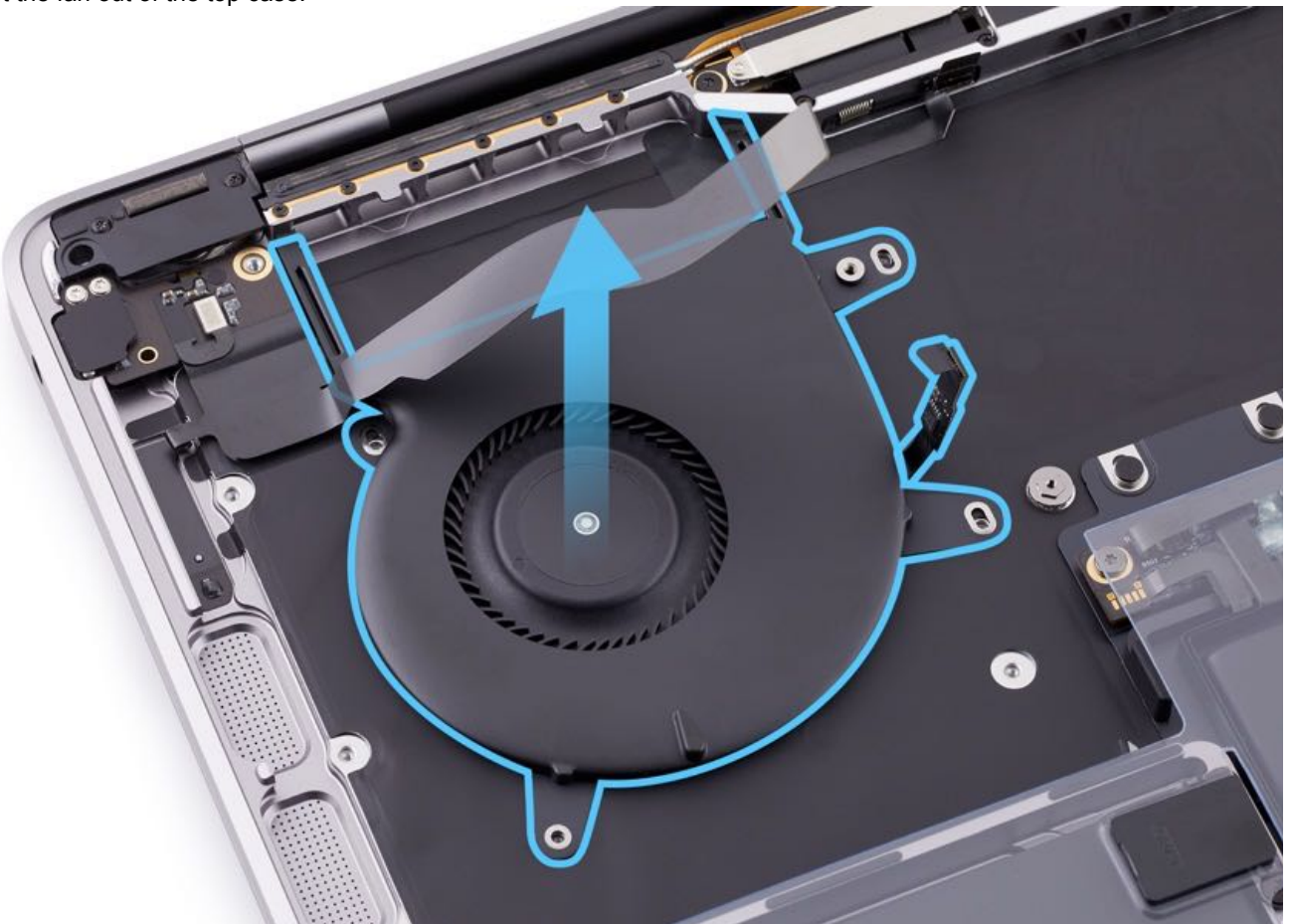
1. The audio board flex assembly cable is adhered to the fan. Gently lift the cable to loosen the adhesive and separate the cable from the fan.



2. Remove four T5 screws from the fan.

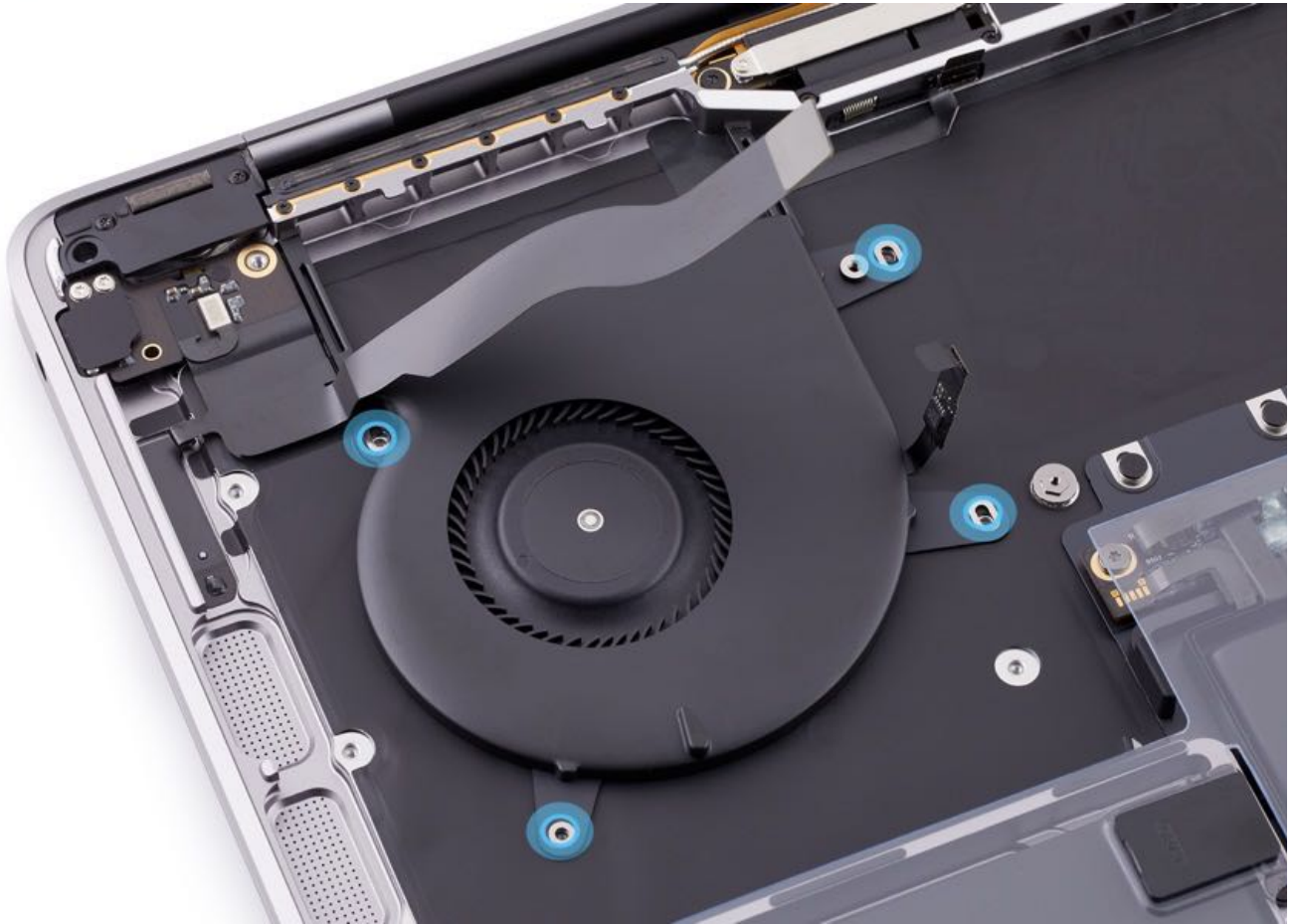


3. Lift the fan out of the top case.



Steps For Reassembly

1. Position the fan in the top case and reinstall four T5 screws (923-04187).
Important: Install the bottom left screw first.



2. With the flat end of a black stick, gently press on the top of the audio board flex cable assembly to adhere it to the fan.



3. Reinstall the [right speaker](#).
4. Reinstall the [logic board](#).

5. [Reconnect the battery and remove the battery cover](#).
6. Reinstall the [bottom case](#).

Repair Completion:

7. [System Configuration](#) must be performed after a [logic board](#), [Touch ID board](#), [display](#), and [top case](#) repair.
8. Perform the [Trackpad Calibration Check](#) to verify trackpad performance after every repair.

Post Repair Verification:

9. After repair completion, verify the repair was successful by running the [required AST 2 diagnostics based on the repair module that was replaced](#).

MacBook Pro (13-inch, 2020, Two Thunderbolt 3 Ports) Trackpad and Flex Cable

First Steps



Caution:

- Only [Apple-certified technicians](#) should perform this procedure.
- To avoid damaging parts, ensure that you have [attached the battery cover and disconnected the battery](#) .
- Do not apply external power while the computer is under repair.
- Wear an ESD wrist strap and take precautions to avoid ESD.

Note:

- Some of the images may be of a different MacBook Pro model, however the procedure is the same for MacBook Pro (13-inch, 2020, Two Thunderbolt 3 Ports).

Remove:

- [Bottom Case](#)
- [Attach the Battery Cover and Disconnect the Battery](#)



Tools

1. 10–34 Ncm torque driver (set to 16 Ncm) (923-02995)
2. T5 security bit (923-02996)
3. Torx T5 screwdriver
4. Black stick
5. ESD-safe tweezers
6. Gap offset tools (923-02998)
7. Sticky Notes
8. Kapton tape

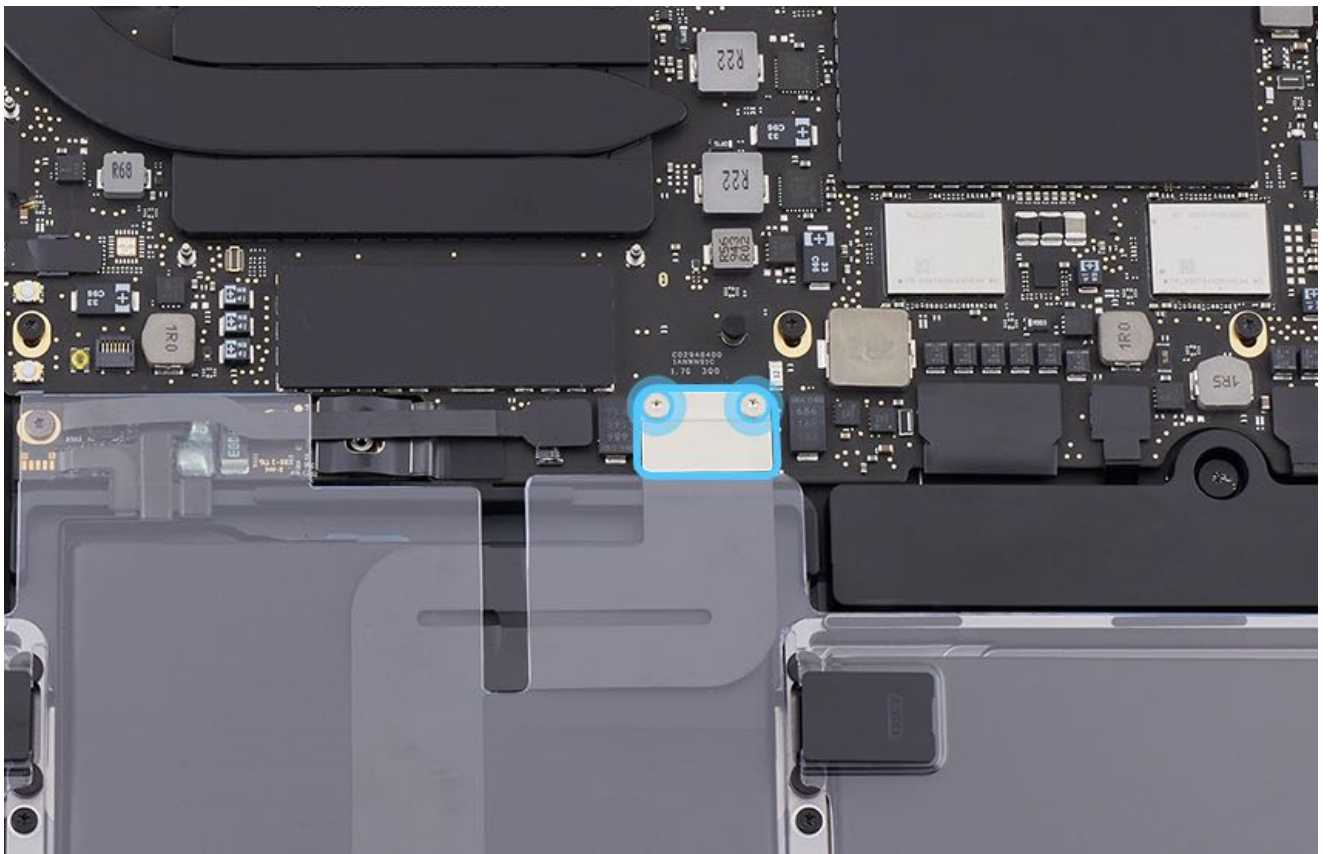


Steps For Removal

1. Open the computer and place the top case on the table with the display over the table edge.



2. Remove two T3 screws from the trackpad flex cable cowling, then remove the cowling. Disconnect the trackpad flex cable from the logic board.



3. Remove eight T5 side screws and two T5 center screws.

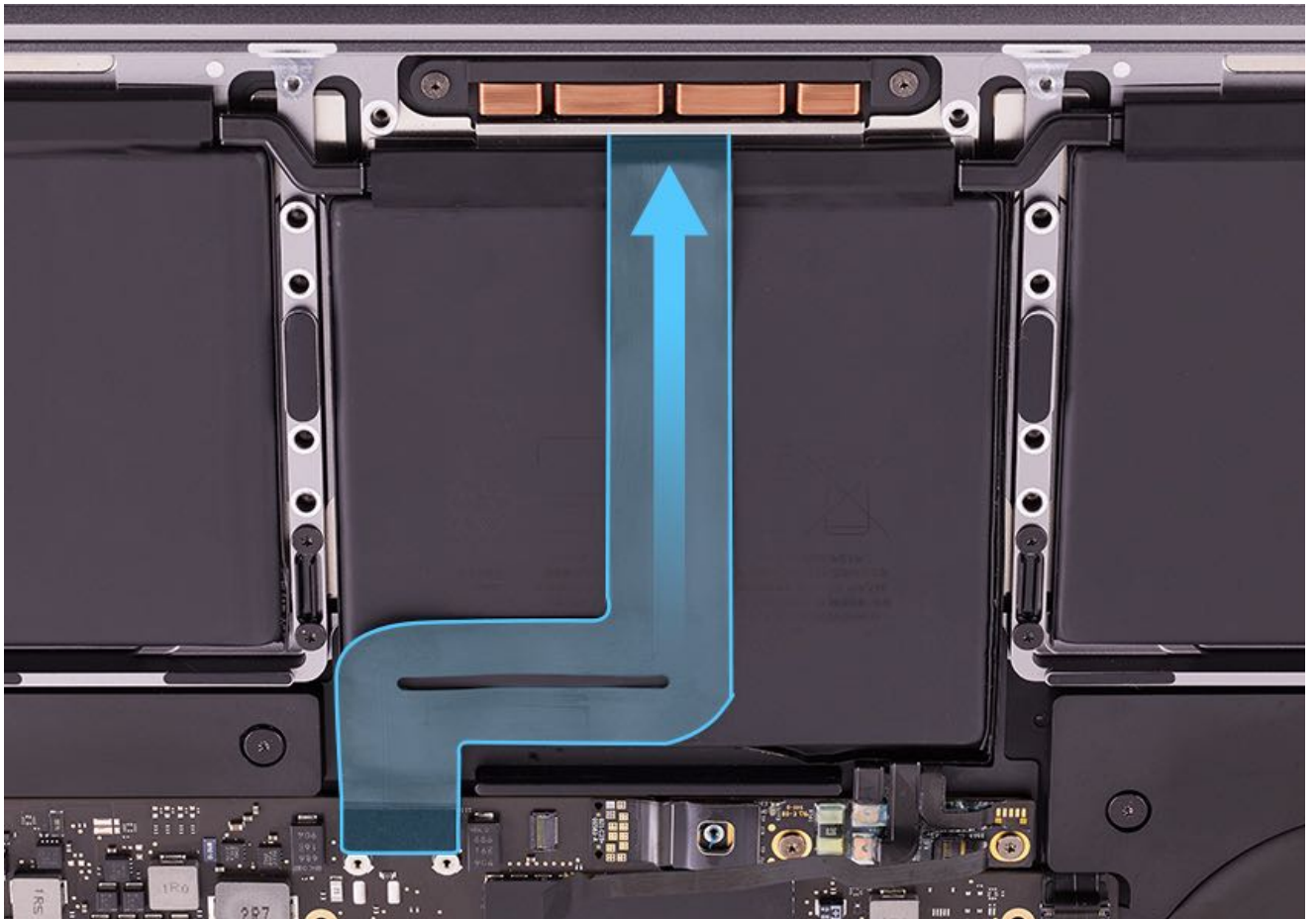


4. Temporarily remove the battery cover.

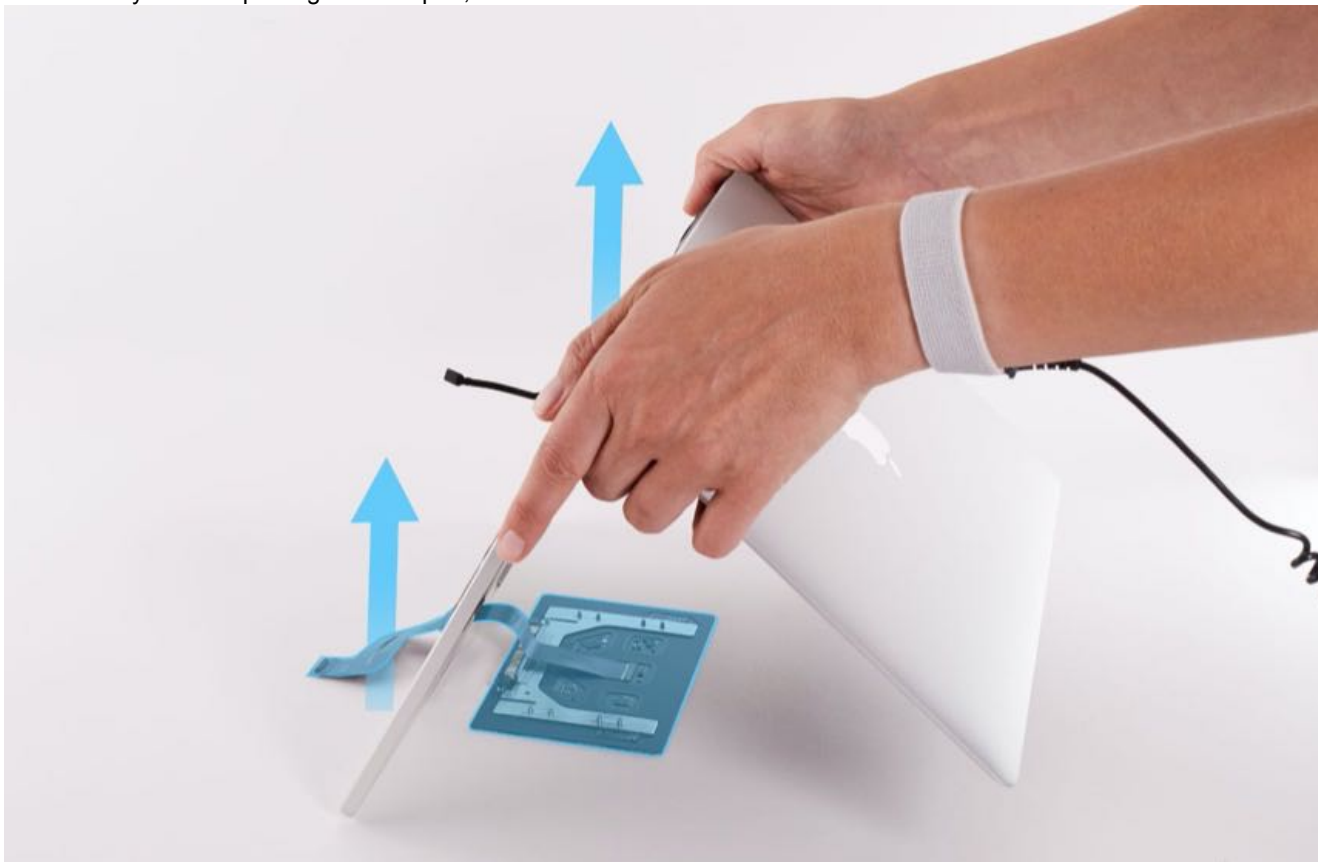


Warning: Don't use a black stick or metal tool when the battery cover is removed. Use your fingers only.

5. The trackpad flex cable is adhered to the battery cells. Using your fingers only, carefully separate the keyboard flex cable from the battery cell.



6. Lift the computer off the table while threading the trackpad cable through the top case opening. Leave the trackpad flat on the table to prevent the shims from falling off and getting lost.
Caution: If you are replacing the trackpad, install new shims.



7. Replace the battery cover and set the computer assembly aside.



Steps For Reassembly



Important:

- If reinstalling the same trackpad, don't remove the trackpad flex cable unless it is damaged. If installing a new trackpad, replace the trackpad flex cable with a new one that is included with the replacement part.



- A replacement trackpad comes with three sizes of shims (0.100 mm, 0.150 mm, and 0.200 mm). Start with the 0.150 mm shim. Using ESD-safe tweezers, install new rectangle shims to the outer screw bosses and round shims to the middle screw bosses on the replacement trackpad.

Part Number	Size
806-05635	0.100 mm rectangle
806-05753	0.150 mm rectangle
806-05636	0.200 mm rectangle
806-05806	0.100 mm round
806-05808	0.150 mm round
806-05810	0.200 mm round

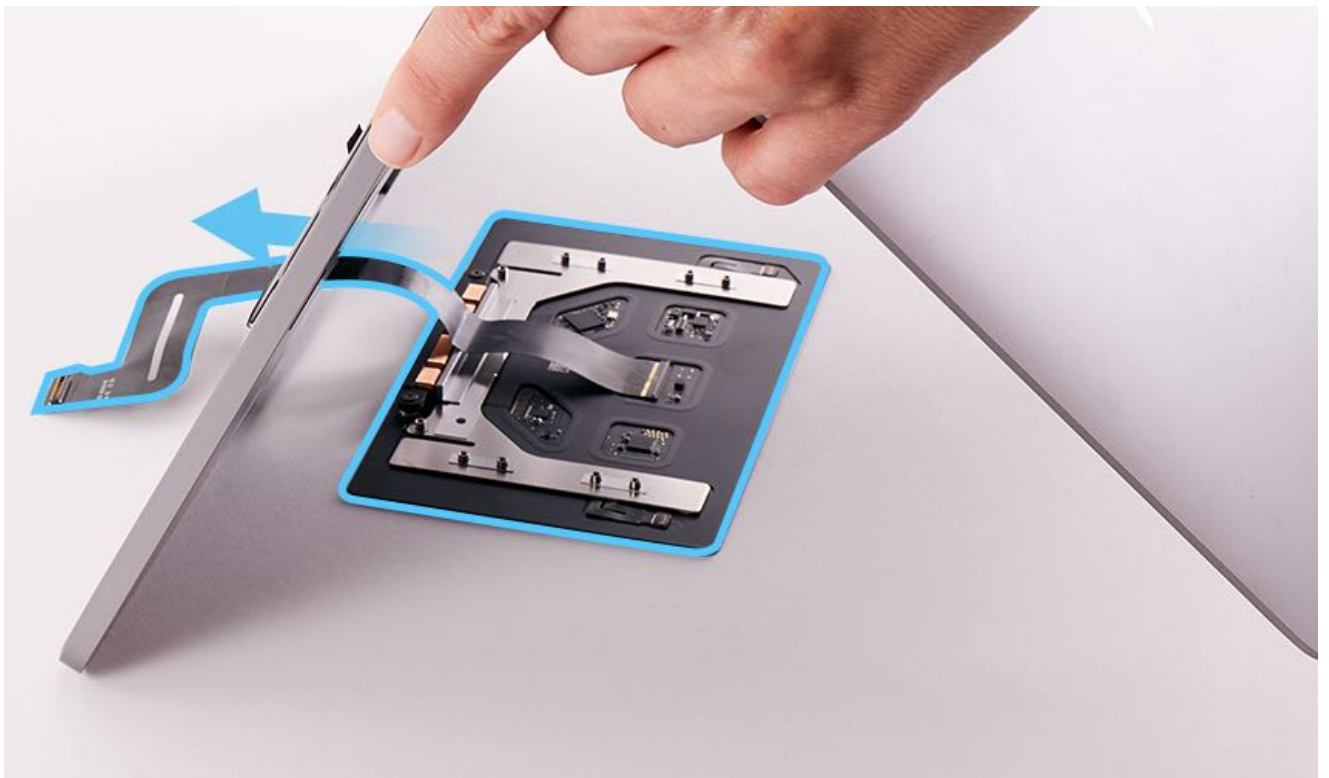


1. Temporarily remove the battery cover.

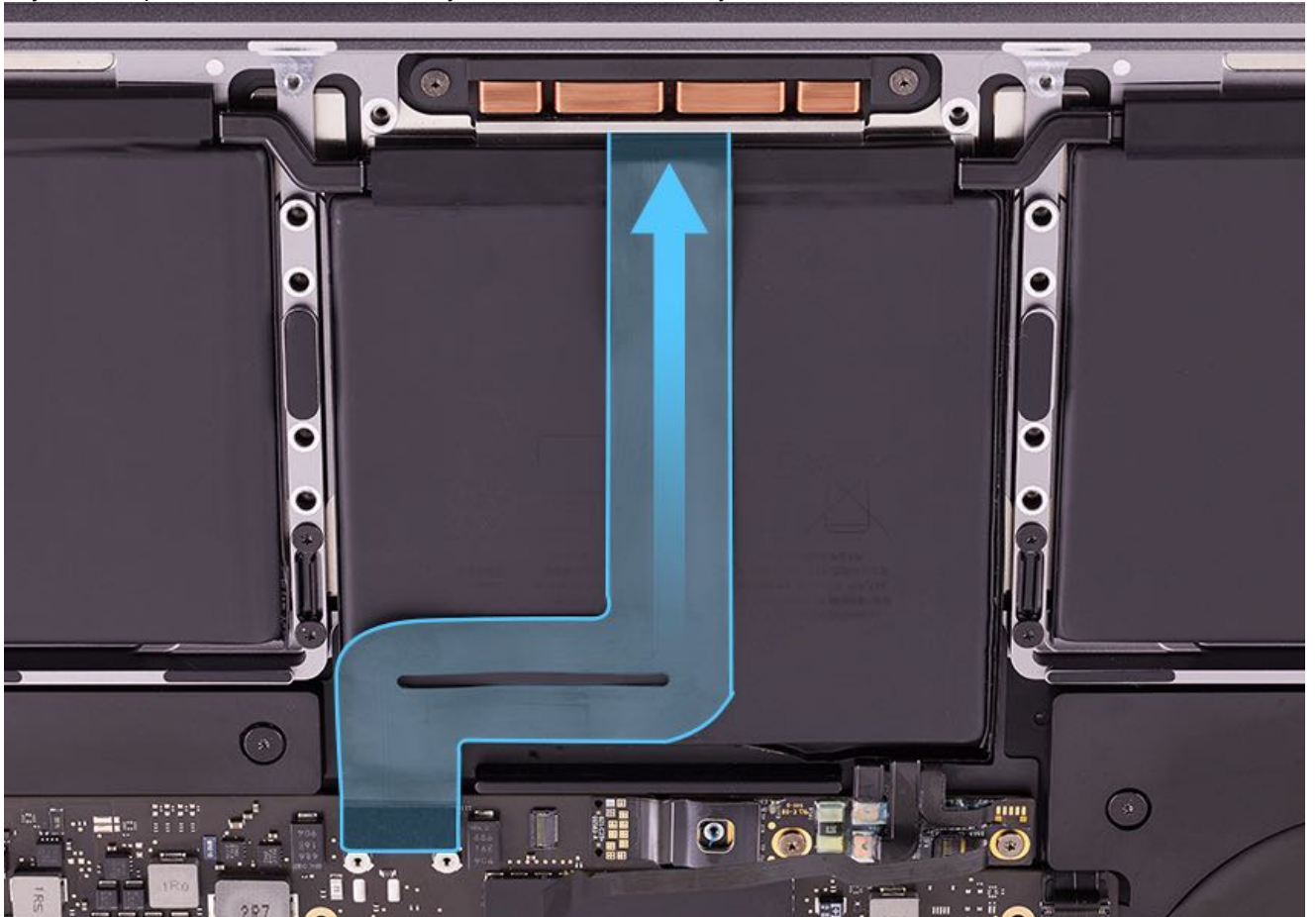


Warning: Don't use a black stick or metal tool when the battery cover is removed.

2. Place the trackpad flat on the table with the trackpad flex cable extended away from you. Thread the keyboard flex cable back through the opening in the top case. Slowly lower the computer with the display over the table edge and align the middle screw holes in the top case with the middle trackpad screw bosses.



3. Lay the trackpad flex cable flat, but don't yet adhere it to the battery cells.



4. Reinstall the battery cover.



5. Partially install four T5 side screws (923-03558) in the outer screw holes to allow for trackpad alignment.

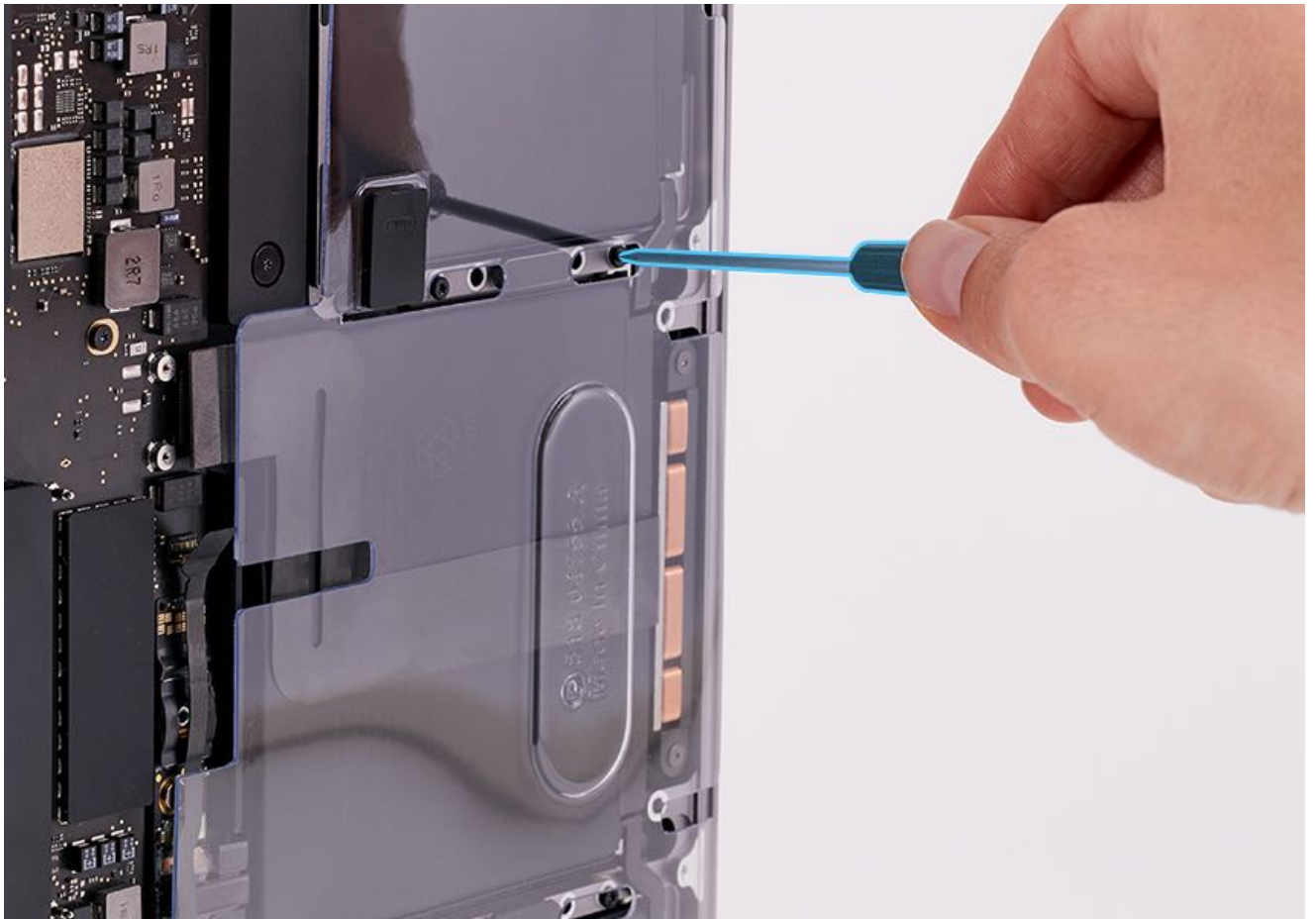




6. Turn the computer over and insert four gap offset tools in the corners of the trackpad. Place a piece of Kapton tape on each gap tool to keep the tools in place.



7. Place the open computer on its side. Use a T5 screwdriver to tighten the four outer screws.



8. To test the trackpad is at the correct height, align a single sticky note on the upper edge of the trackpad. Run a finger over the top case and trackpad to verify the trackpad is flush with the sticky note.



9. Align a stack of two sticky notes to the bottom edge of the trackpad. Run a finger over the top case and trackpad to verify the trackpad is flush with the sticky note.



Important: Important: If the trackpad is correctly aligned, continue with reassembly step #10. If the trackpad edges are higher or lower than the top case, follow removal steps #4-7 to remove the trackpad. Install the thinner 0.100 mm shims if the trackpad is higher than the top case. If the trackpad is lower than the top case, install the thicker 0.200 mm shims. Then, follow reassembly steps #1-9 to check alignment again.



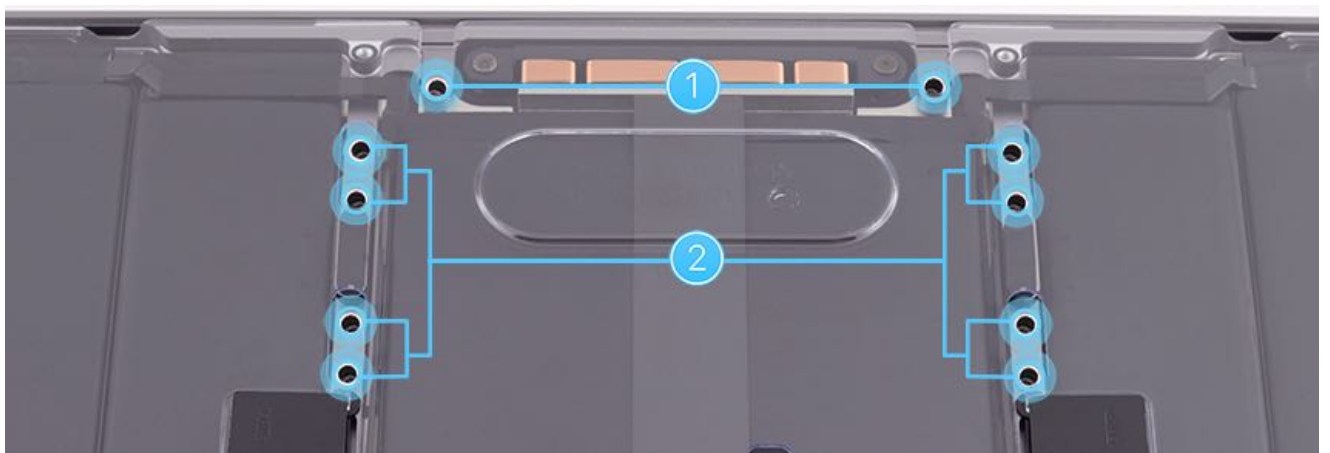
10. Insert the T5 security bit into the adjustable 10–34 Ncm torque driver (923-02995). Set the torque value to 16 Ncm.



11. Reinstall the remaining four side T5 screws and two middle T5 screws. Then, tighten all 10 screws to 16 Ncm.
1. 923-03558 (side screws)



2. 923-03557 (middle screws)

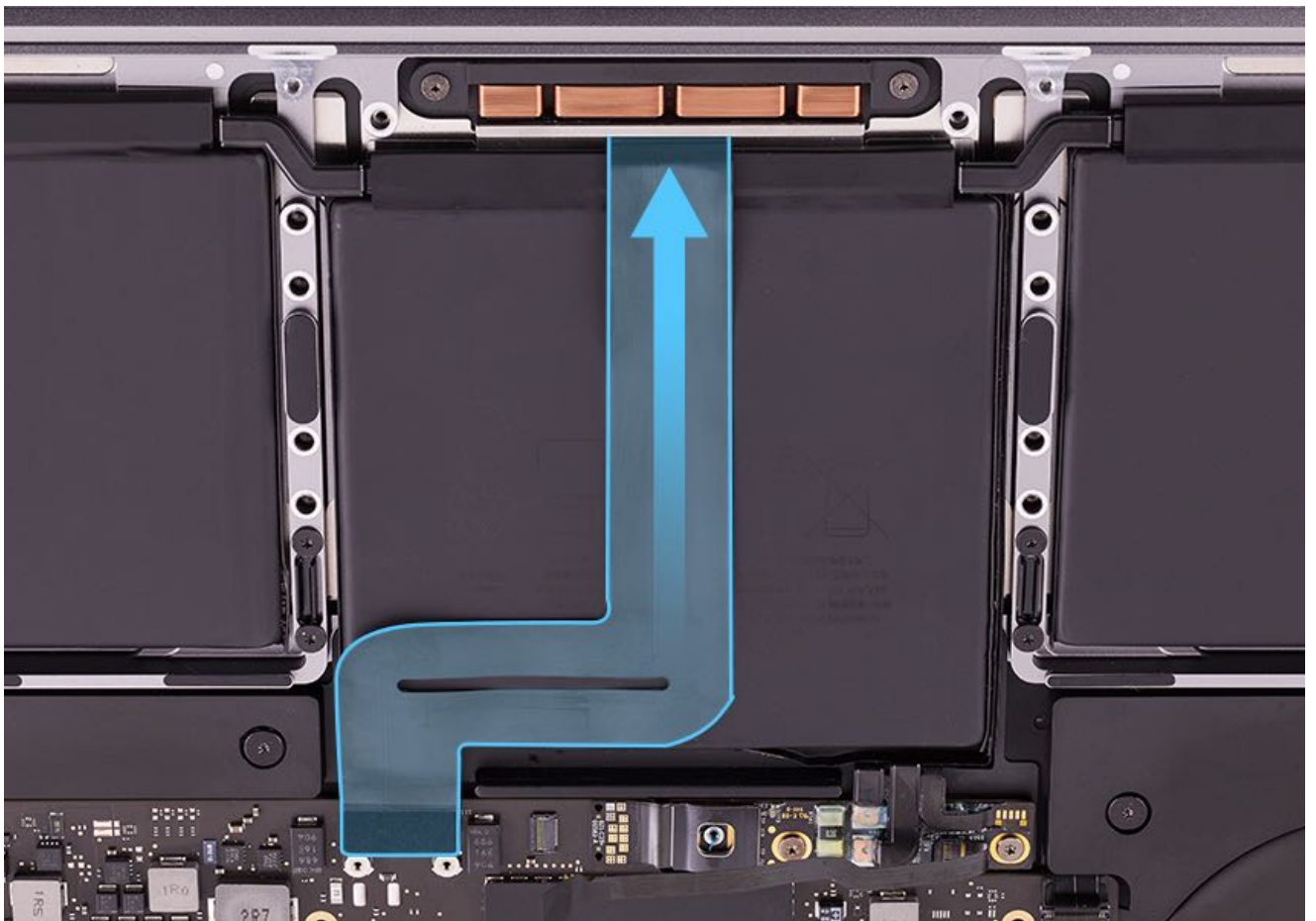


12. Temporarily remove the battery cover.



Warning: Don't use a black stick or metal tool when the battery cover is removed.

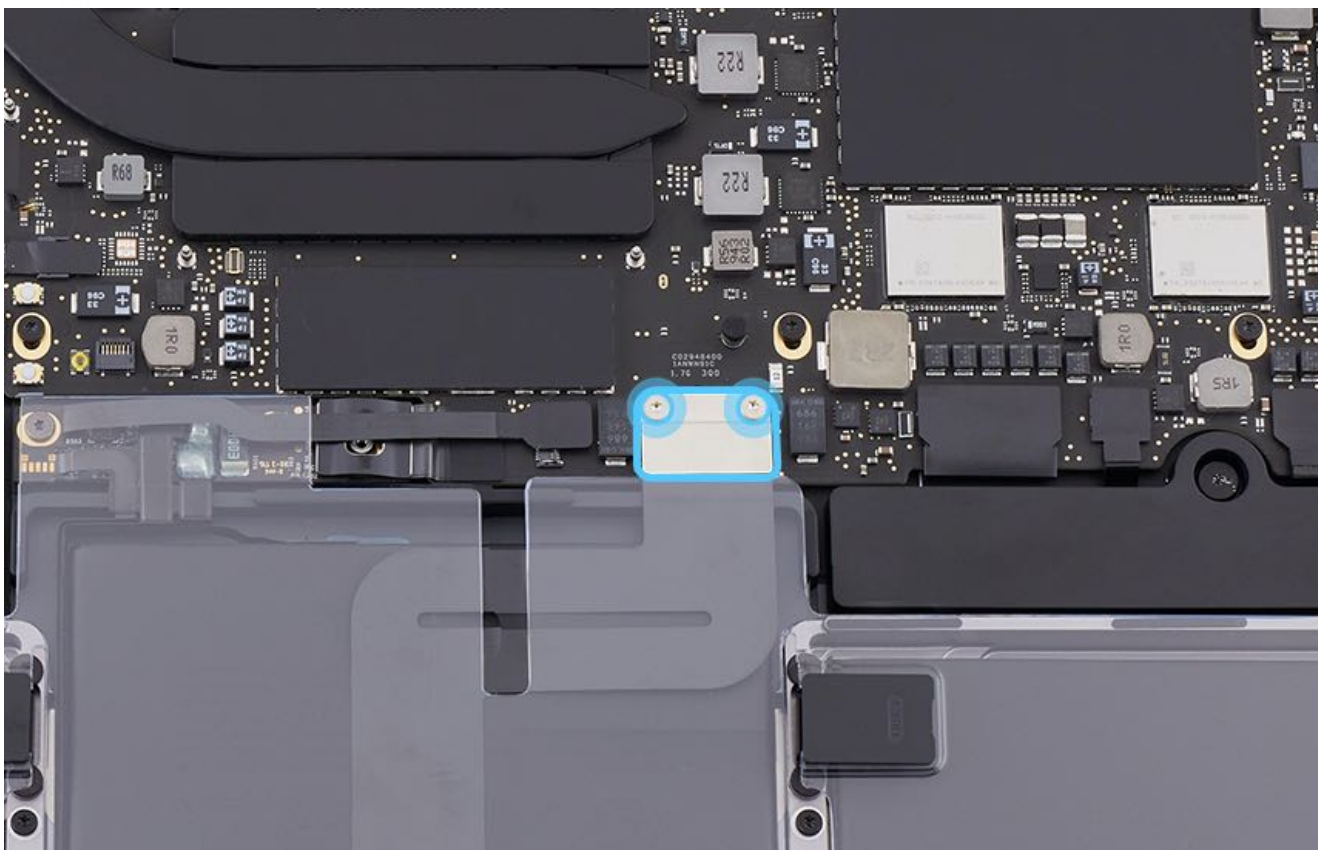
13. Gently run your finger along the trackpad flex cable to readhere it to the battery cells.
Important: If installing a new trackpad flex cable, first remove the adhesive backing before adhering the flex cable to the battery cells.



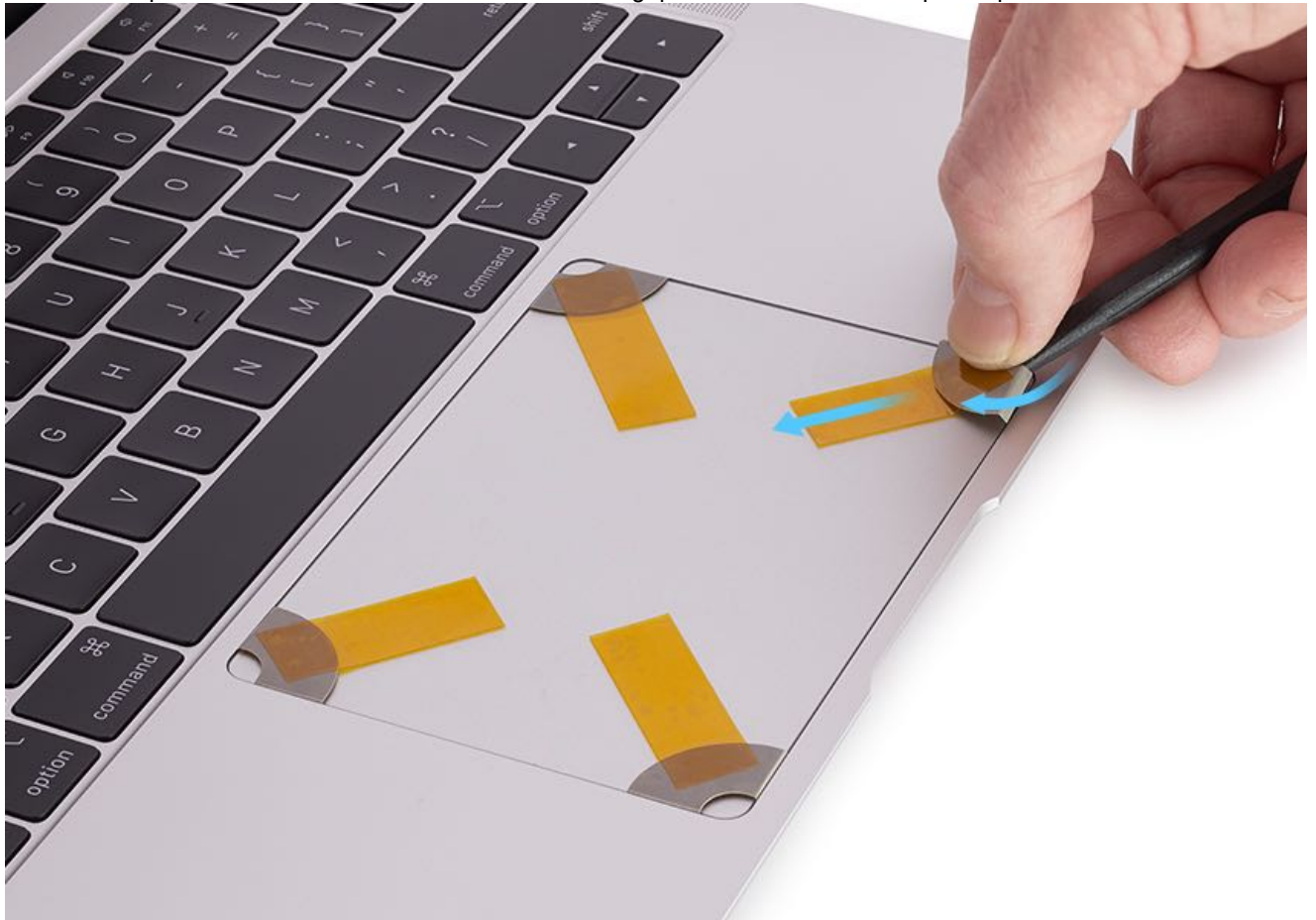
14. Reinstall the battery cover.



15. Reconnect the trackpad flex cable to the logic board. Reinstall the trackpad flex cable cowling and two T3 screws (923-01641).



16. Turn the computer over and use a black stick to lift off the gap offset tools and the Kapton tape.



17. [Reconnect the battery and remove the battery cover.](#)
18. Reinstall the [bottom case](#).

Repair Completion:

19. [System Configuration](#) must be performed after a [logic board](#), [Touch ID board](#), [display](#), and [top case](#) repair.
20. Perform the [Trackpad Calibration Check](#) to verify trackpad performance after every repair.

Post Repair Verification:

21. After repair completion, verify the repair was successful by running the [required AST 2 diagnostics based on the repair module that was replaced](#).

MacBook Pro (13-inch, 2020, Two Thunderbolt 3 Ports) Top Case Assembly with Battery

First Steps



Caution:

- Only [Apple-certified technicians](#) should perform this procedure.
- To avoid damaging parts, you must [attach the battery cover and disconnect the battery](#) .
- Don't connect the computer to any external power source during repair.
- Wear an ESD wrist strap and take precautions to avoid ESD.

Important:

- Regional top cases have the same base part number, but they include a language code prefix (for example, Italian = T661-15736). [Choose the correct keyboard language](#) (HT201794) when ordering a top case.

System Configuration:

- Run the [System Configuration Suite](#) . If you don't run the System Configuration Suite after you replace a [logic board](#), [Touch ID board](#), [display](#), or [top case](#), the computer will be unresponsive.

Remove:

- [Bottom Case](#)
- [Attach the Battery Cover and Disconnect the Battery](#)
- [BMU Flex Cable](#)
- [Clutch Covers](#)
- [Speakers](#)
- [Vent/Antenna Module](#)
- [Display](#)
- [Logic Board](#)
- [I/O Board](#)
- [Audio Board Flex Assembly](#)
- [Touch ID Board](#)
- [Fan](#)
- [Trackpad and Trackpad Flex Cable](#)



Tools

- No tools are required.

Steps For Removal

After all the items listed above are removed, the top case is the only remaining part.

The top case includes the following:

- Battery and BMU board
- Keyboard and keyboard flex cable
- Microphone
- Touch Bar touch flex cable
- Touch Bar display flex cable



Steps For Reassembly

1. Reinstall the [trackpad and trackpad flex cable](#).
2. Reinstall the [fan](#).
3. Reinstall the [Touch ID board](#) and apply new adhesive to the [Touch ID board flex cable](#).
4. Reinstall the [audio board flex assembly](#).
5. Reinstall the [I/O board](#).
6. Reinstall the [logic board](#).
7. Reinstall the [display](#).
8. Reinstall the [vent/antenna module](#).
9. Reinstall the [speakers](#).
10. Reinstall the [clutch covers](#).
11. Reinstall a new [BMU flex cable](#) that came with the top case.
12. [Reconnect the battery and remove the battery cover](#).
13. Reinstall the [bottom case](#).

Repair Completion:

14. Run the [System Configuration Suite](#) .
Caution: If you don't run the System Configuration Suite after you replace a [logic board](#), [Touch ID board](#), [display](#), or [top case](#), the computer will be unresponsive.
15. Run the [Trackpad Calibration Check](#) .

Post Repair Verification:

16. Run the [required AST 2 diagnostics for the parts that you replaced](#) .

System Configuration for Mac Computers with the Apple T2 Security Chip

System Configuration for Mac Computers with the Apple T2 Security Chip

Important: If you replace the logic board or flash storage in the user's computer, ensure the data is backed up now. You can't recover data after you run the System Configuration suite.



A repair of a Mac computer with the Apple T2 Security Chip isn't complete until you successfully run the AST 2 System Configuration suite. Successfully running the AST 2 System Configuration suite ensures repair quality and compliance with regional communications regulations. Successfully running the AST 2 System Configuration suite also ensures that the Apple T2 Security Chip works, enabling hardware encryption, biometric authentication, and secure startup protection.

The System Configuration Suite optimizes performance and performs tests in the following ways:

- The System Configuration suite conducts tests that verify that you correctly replaced parts and correctly reconnected parts related to the Apple T2 Security Chip during the repair. The System Configuration suite conducts test for parts including the Touch ID sensor, ambient light sensor, Touch Bar, display, and camera.
- The System Configuration suite pairs the Touch ID sensor and Touch Bar to the logic board and updates their calibration values for performance optimization. If you replaced the logic board, the System Configuration suite writes the system serial number to the new logic board and reports it to Apple. Reporting the logic board serial number to Apple enables iCloud services including FaceTime, Messages, and Apple Pay, and assigns the wireless region.
Note: To comply with regional communications regulations, the computer will display a flashing circle with a line through it (prohibitory symbol) until the System Configuration suite assigns the wireless region.
- The final step for all repairs is to update the Apple T2 Security Chip firmware to the most current version.
- You can see the completed steps in the AST 2 Diagnostic Console by selecting the suite in Diagnostics Results and clicking Details.

This article has the following sections:

- [When System Configuration Is Required](#)
- [Tools](#)
- [Before Starting an AST 2 Session](#)
- [Steps](#)
- [Troubleshooting Tips](#)

System Configuration is used to ensure key modules are properly calibrated and paired with the logic board after a repair. The chart below details when System Configuration is always required.

When System Configuration Is Required

Perform System Configuration after these part replacements:

Computer Model	Logic Board	Top Case	Display	Touch ID	Flash Storage	Lid Angle Sensor (LAS)
iMac Pro (2017)	•				•	
Mac mini (2018)	•					
MacBook Air (Retina, 13-inch, 2018)	•			•		
MacBook Air (Retina, 13-inch, 2019)	•		•	•		
MacBook Air (Retina, 13-inch, 2020)	•		•	•		
MacBook Pro (13-inch, 2019, Two Thunderbolt 3 Ports)	•	•	•	•		
MacBook Pro (13-inch, 2020, Two Thunderbolt 3 Ports)	•	•	•	•		
MacBook Pro (13-inch, 2018, Four Thunderbolt 3 Ports)	•	•	•	•		
MacBook Pro (13-inch, 2019, Four Thunderbolt 3 Ports)	•	•	•	•		
MacBook Pro (13-inch, 2020, Four Thunderbolt 3 Ports)	•	•	•	•		
MacBook Pro (15-inch, 2018)	•	•	•	•		
MacBook Pro (15-inch, 2019)	•	•	•	•		
MacBook Pro (16-inch, 2019)	•	•	•	•		•
Mac Pro (2019) and Mac Pro (Rack, 2019)	•				•	

Tools

- Power cord
 - USB-C Charge Cable (661-06670) or USB-C to USB-A Cable (923-00504)
- Important:** Don't use Thunderbolt 3 cables.



- A host computer with:
 - macOS Catalina 10.15 or later
 - [Mac Configuration Utility \(MCU\)](#)
 - [The Latest Apple Service Toolkit](#)

Note: Do not use third-party web browsers on a host computer with MCU. Third-party web browsers may impact the performance of System Configuration when MCU and third-party web browsers are open at the same time. Remove any third-party web browsers and then restart the MCU host computer.
- Internet connection

Before Starting an AST 2 Session

1. Add the parts you replaced to the repair.
2. Add the known good board (KGB) and known bad board (KBB) serial numbers to the repair.

Important: If you incorrectly enter or don't save the the serial numbers in the repair system, the System Configuration suite won't be available.
3. Save the repair.

Note:

- You must use upper case characters for letters in the logic board serial number. To ensure accuracy, it is recommended to scan the QR code on the logic board.
- Close the display after putting the computer into DFU mode.

Steps

1. Start a diagnostic session on the AST 2 [Diagnostic Console](#).
 2. Plug in the user's computer and the host computer.
 3. Connect the user's computer to the host computer. If the host computer doesn't have a USB-C port, use a USB-C to USB-A cable. Don't use a USB-C to USB-A cable with a USB-C to USB Adapter.
- Important:** You must connect the USB-C cable to the correct port on the user's computer.

Notebooks: Use the USB-C port closest to the Caps Lock key.



iMac Pro: Use the USB-C port closest to the Ethernet port.



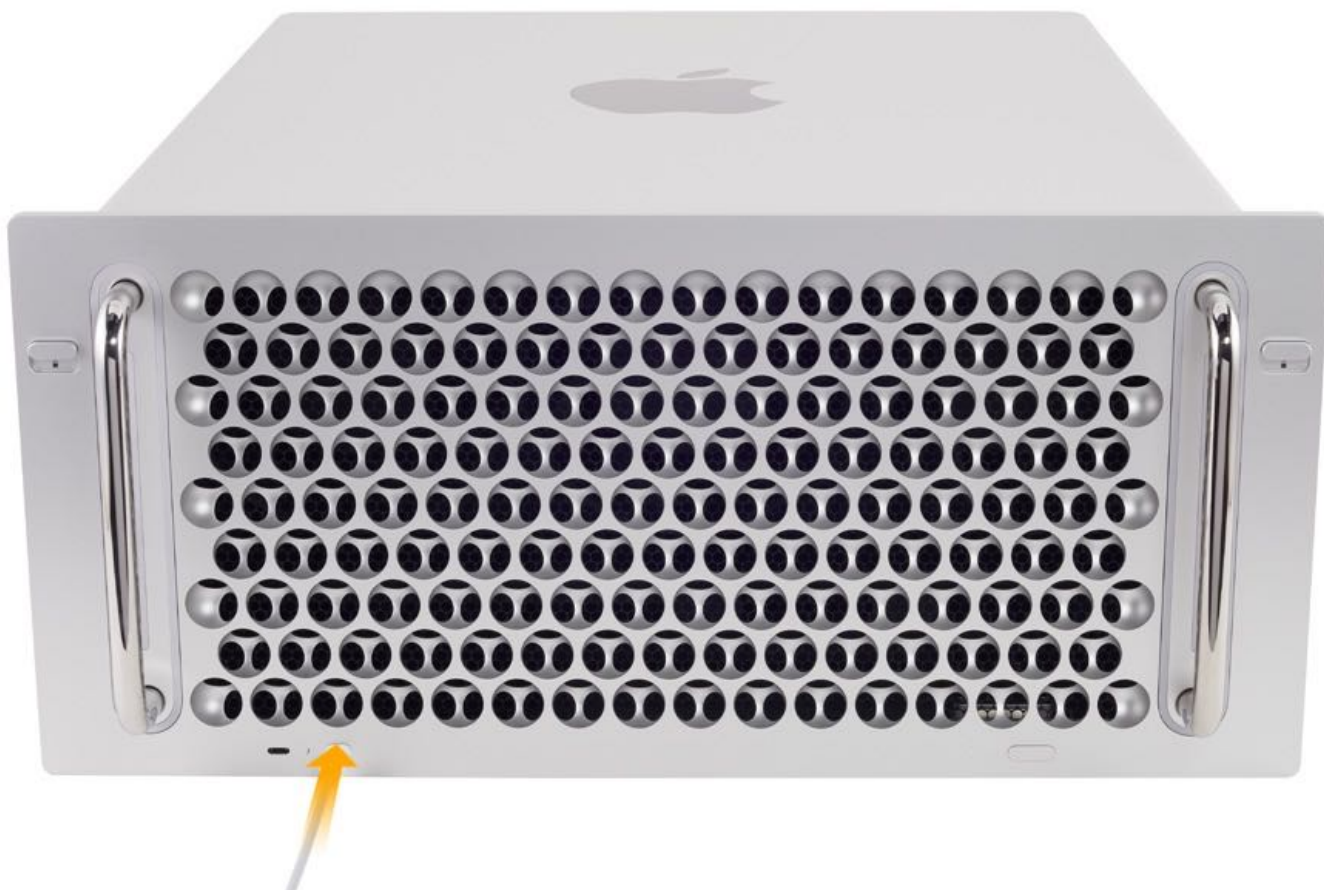
Mac mini (2018): Use the USB-C port closest to the HDMI port.



Mac Pro (2019): Use the outer USB-C port closest to the edge.



Mac Pro (Rack, 2019): Use the USB-C port closest to the power button.

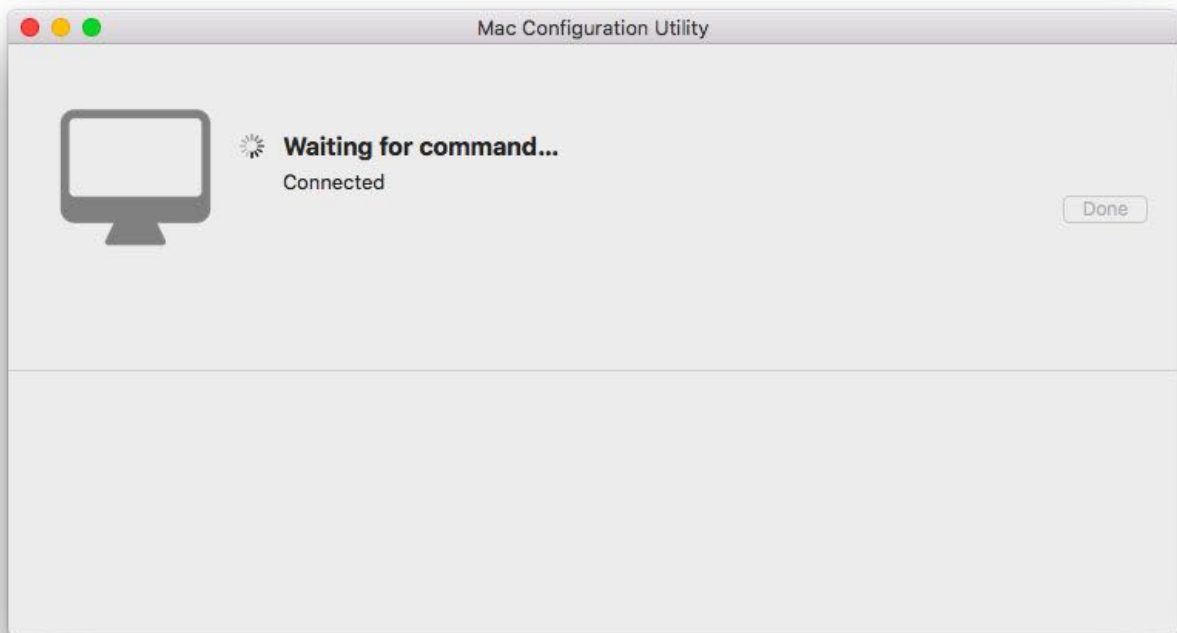


4. Turn on the host computer and connected it to the internet.

5. Start up the user's computer in [DFU mode](#) . If DFU has been performed correctly, MCU will automatically launch and a dialog box will appear on the host computer screen.

- [For desktop computers](#) : Press and hold the power button while connecting the power cord and until the prompt appear in Mac Configuration Utility, which may take up to 10 seconds.
- [For notebooks](#) : Press and hold the power button, then press and hold Left Control-Left Option-Right Shift until you see the prompt appear in Mac Configuration Utility, which may take up to 10 seconds.

Important: For display repair and LAS repair in MacBook Pro (16-inch, 2019), look for a prompt to close the display. If you don't close the display when prompted, the System Configuration suite won't run properly and you will need to replace the LAS.



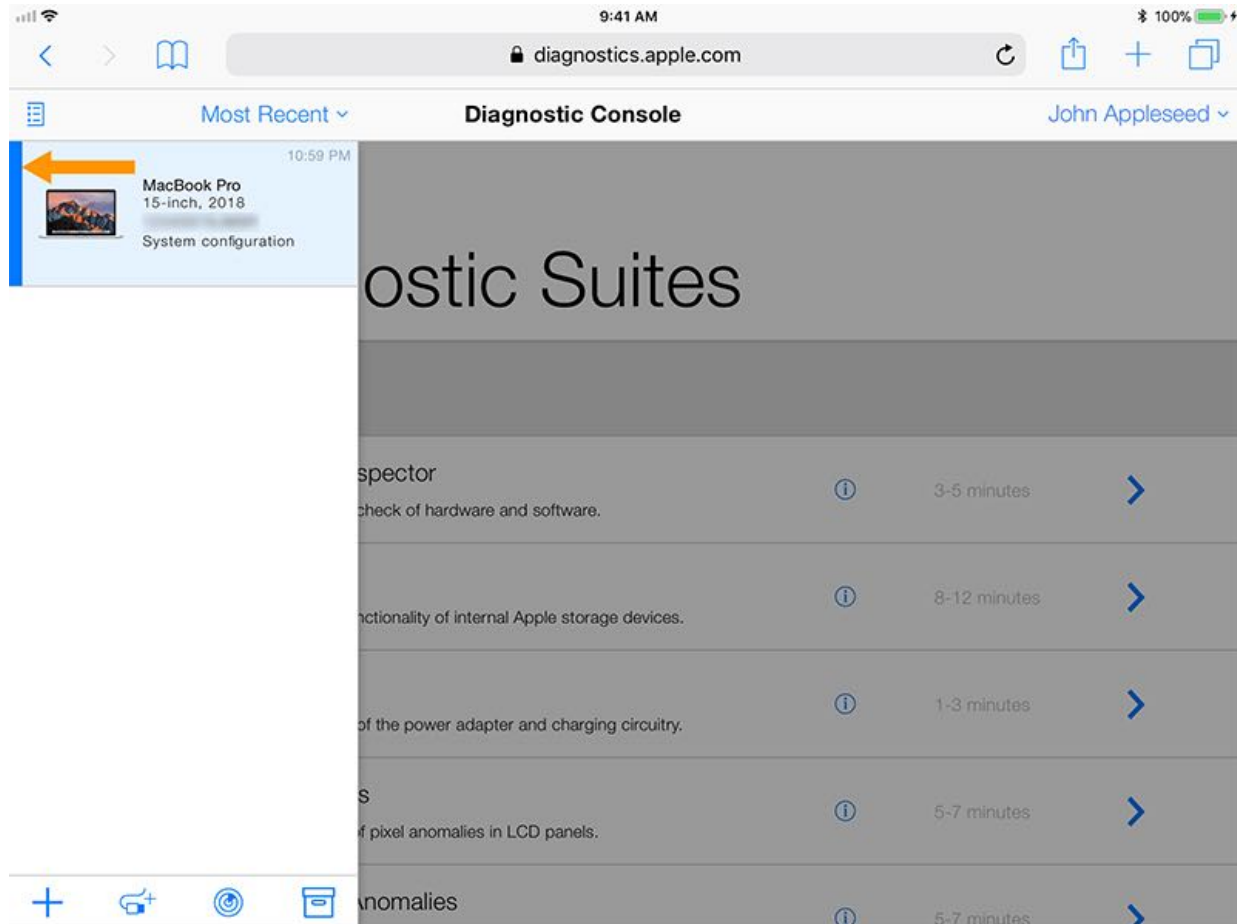
Note: If you haven't created a diagnostic session yet, a "Waiting for session..." message will appear.



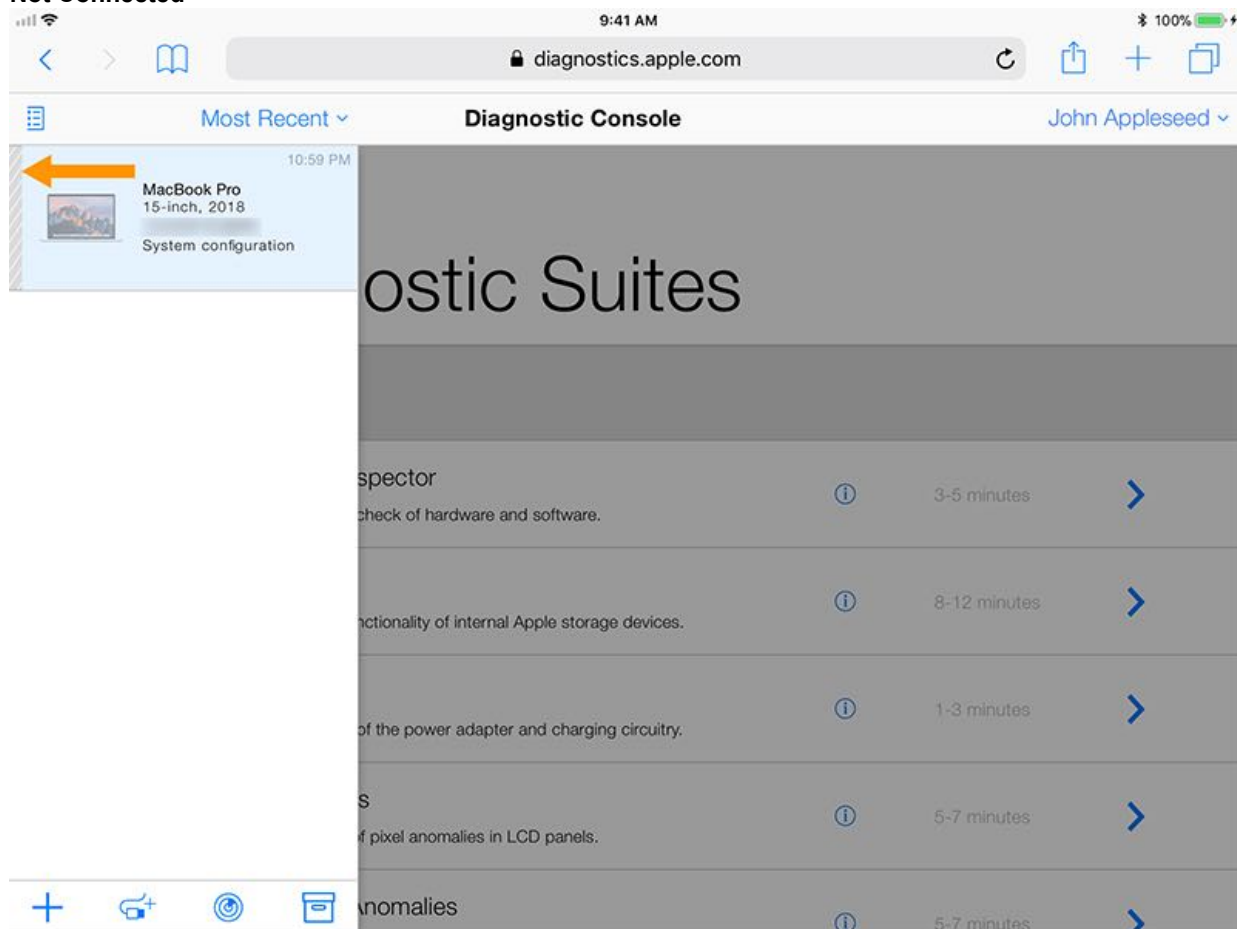
6. Confirm that a blue bar is next to the name and serial of the user's computer.

Note: If the computer doesn't appear on screen, you may have incorrectly entered the serial number or incorrectly saved the repair. Both the system serial number and the part serial numbers must be accurate to continue.

Connected



Not Connected



7. Choose the System Configuration suite from the Diagnostic Console. Eventually the Apple logo and a progress bar will appear, the user's computer will restart, and test results will appear in the Diagnostic Console.

9:41 AM

diagnostics.apple.com

100%

Diagnostic Console

John Appleseed

Diagnostic Suites

POST-REPAIR

Full System Diagnostic (EFI)

Performs comprehensive testing of hardware functionality and memory module integrity.

30-90 minutes

>

Full System Diagnostic (OS)

Performs comprehensive testing of hardware and graphics functionality.

15-30 minutes

>

REPAIR COMPLETION

System Configuration

Completes required configuration of applicable service parts and updates firmware after repair. This suite becomes available after service part serial numbers are saved in a repair. For more information refer to TP1657: System Configuration.

1-10 minutes

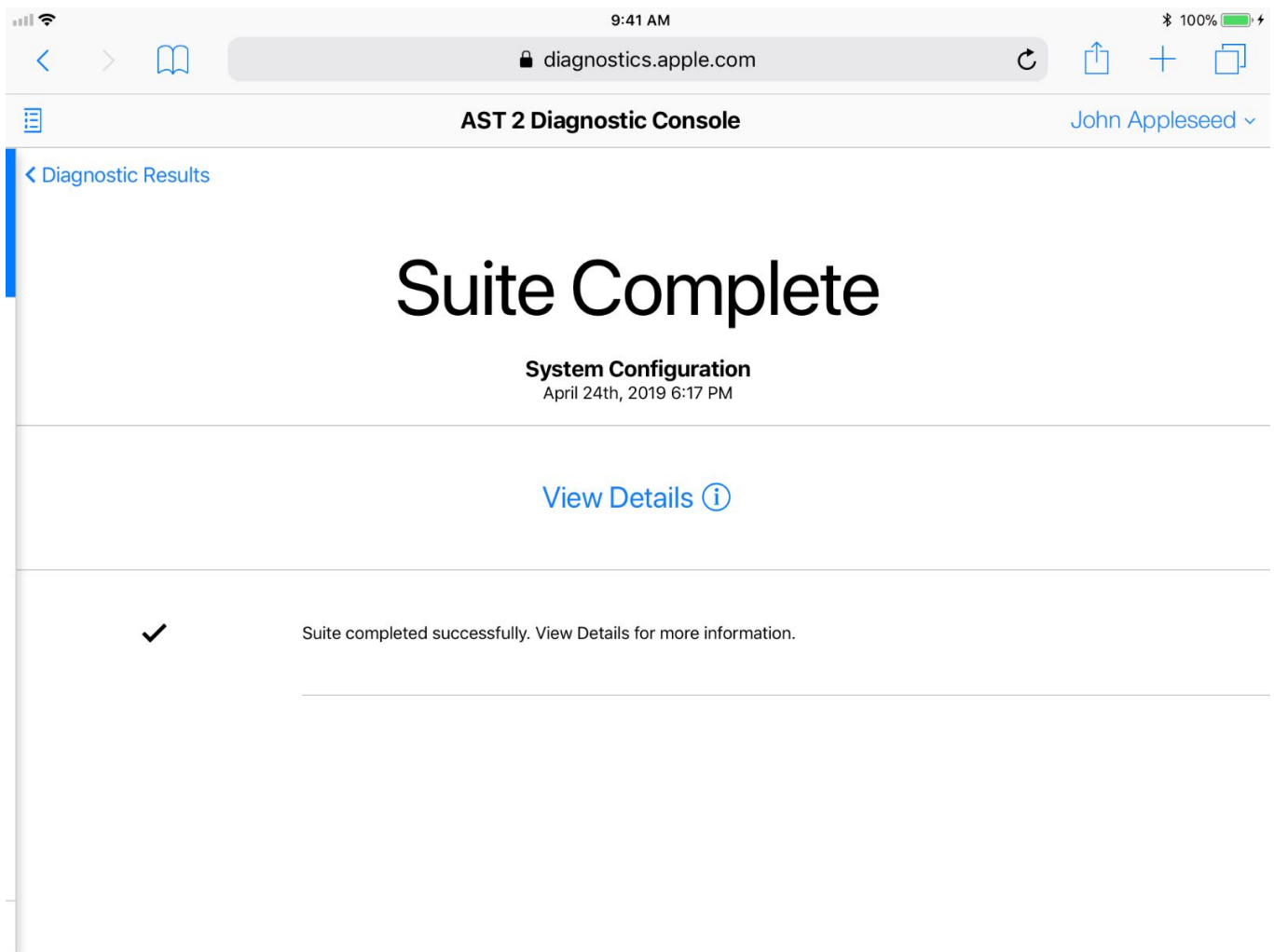
>

Trackpad Calibration Check

Verifies calibration of the trackpad actuator and force sensor. This suite must be run each time the computer is opened and reassembled.

3-7 minutes

>



Note:

- While the System Configuration suite is running, the display on the user's computer will mostly stay blank.
- Firmware restoration will take about two minutes.

10. If no issues are found, restart the user's computer and run MRI as well as all applicable diagnostics.

- For notebooks, you must run the [Trackpad Calibration Check suite](#) any time you open the computer.

Note: For iMac Pro, macOS needs to be reinstalled. Shut down the computer and then restart in recovery mode to install the macOS from Internet Recovery.

11. If issues are found and a diagnostic test fails, follow the instructions on the Diagnostic Console and escalate to CSS.

Troubleshooting Tips

If the session does not activate (the gray bar doesn't turn blue), verify the following information:

1. The host computer is connected to the internet.
2. The user's computer is connected to power.
3. The user's computer is in [DFU mode](#).
4. You're using the correct port on the user's computer.
5. You're using the correct cable for connecting the host computer and the user's computer.
6. You correctly entered the serial number of the user's computer in the repair and in the Diagnostic Console.
7. You correctly added the parts to the repair.

If the System Configuration suite isn't available, perform the following steps:

1. Verify parts have been added to the repair.
2. Verify the KBB and KGB serial numbers are correct.
3. Verify the repair has been saved.
4. Archive and restart the diagnostic session.
5. Restart the host computer.
6. Open the user's computer and confirm that all parts are properly installed and all flex cables are securely connected.
7. If it has been more than 14 days since a logic board, top case, or display KGB *serial number* was added to the repair, escalate to CSS. If it has been more than 14 days since a Lid Angle Sensor or Touch ID *part* was added to the repair,

escalate to CSS.

If the diagnostic session is interrupted (the blue bar turns gray), perform the following steps:

1. Archive and restart the diagnostic session.
2. Check the network connection.
3. Restart the host computer.
4. Verify that the host computer isn't in sleep mode.
5. Open the user's computer and confirm that all parts are properly installed and all flex cables are securely connected.

Trackpad Calibration Check

Trackpad Calibration Check

To verify that the trackpad is responding as expected, the Trackpad Calibration Check suite in AST 2 should be run after every repair, including when only the bottom case has been removed and reinstalled.

Note: It is recommended to also run the Trackpad (OS) suite after a top case has been replaced, or if the user is having issues related to trackpad functionality.

Required Tools:

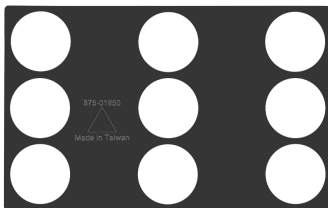
1. Weight Placement Rubber Template (model specific)
 - Refer to the Weight Placement Rubber Template section below to identify the correct template to use.
 - **Important:** If the Weight Placement Rubber Template edges start to curl, order a new pack. Templates come in a pack of three.
2. 200 g and 800 g weights (923-00462)



Weight Placement Rubber Templates:

MacBook (Retina, 12-inch, Early 2015, Early 2016, and 2017)

- **923-00555**



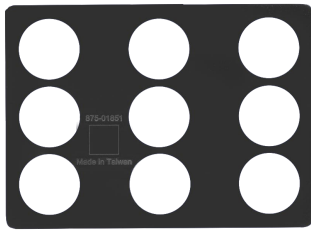
MacBook Air (Retina, 13-inch, 2018, 2019, and 2020)

- **923-02462**



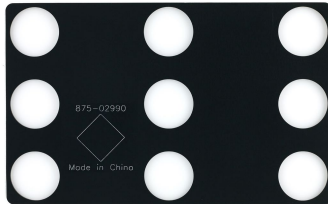
MacBook Pro (Retina, 13-inch, Early 2015) and (Retina, 15-inch, Mid 2015)

- **923-00599**



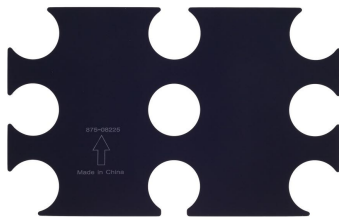
MacBook Pro (13-inch, 2016, 2017, 2018, 2019)

- **923-01316**



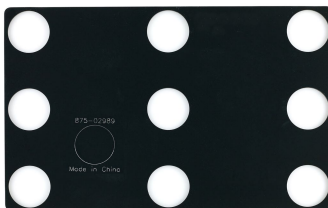
MacBook Pro (13-inch, 2020)

- **923-04161**



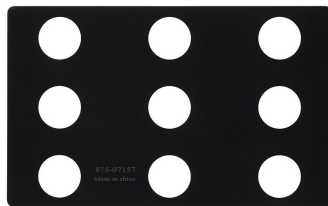
MacBook Pro (15-inch, 2016, 2017, 2018, 2019)

- **923-01317**



MacBook Pro (16-inch, 2019)

- **923-03890**



Steps:

1. Place the appropriate Weight Placement Rubber Template on the trackpad before launching the Trackpad Calibration Check suite in AST 2. This establishes the correct baseline for the weights.
- Important:** Do not tape the Weight Placement Rubber Template to the top case. Tape may cause inaccurate test results.



2. Launch AST 2. In Diagnostic Console, select Trackpad Calibration Check from the list of diagnostic suites.

Caution: The Trackpad Calibration Check suite is very sensitive to external disturbances. Ensure the computer is on a flat surface before you begin. Don't run the Trackpad Calibration Check suite if the computer is on a bench where other technicians are working. To avoid interfering with the results, be sure to place weights down gently on a separate surface while running the suite. If the computer is bumped or jostled while the suite is running, restart the test.

[< Diagnostic Results](#)

Diagnostic Suites

TRIAGE



Trackpad Response

Assists in verifying functionality of trackpad.



3 minutes



REPAIR



Trackpad Calibration Check

Verifies calibration of the trackpad actuator and force sensor.

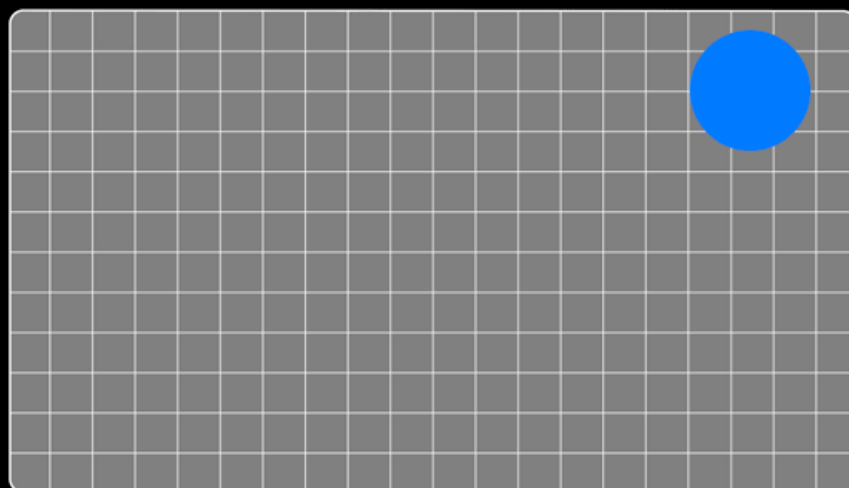


3 minutes



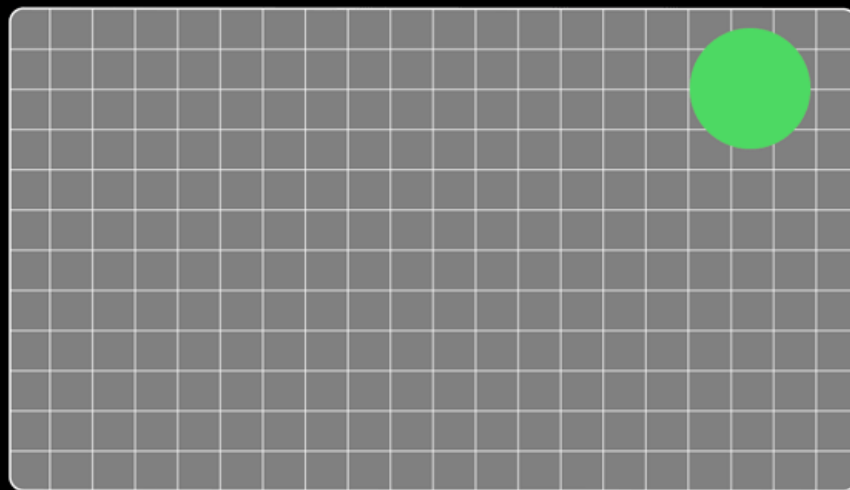
3. The Trackpad Calibration Check suite consists of several stages. The first stage of the suite is the Force Check, which is interactive and requires placing the 200 g and 800 g weights as indicated. The blue dot will indicate where on the trackpad to place each weight. The text at the bottom of the screen will indicate which weight to use at each step. The dot will turn green when it is time to lift the weight from the trackpad.

Important: Don't press just any key. Press an alphanumeric key to advance the test.



Test Instruction

Place the 200g weight on the indicated area and press any key.

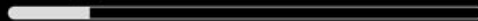


Test Instruction

Remove the weight from the indicated area and press any key.

4. The next stage of the Trackpad Calibration Check suite is the Actuator Check. During this stage, the trackpad will make clicking sounds while the actuator is tested. If any issues with the actuator are identified, the suite may need to proceed to the next stage, which is the Actuator Calibration. The trackpad will continue to make clicking sounds while the actuator is calibrated. During this process, the unit under test (UUT) will display the screen shown below.

Checking your Mac...

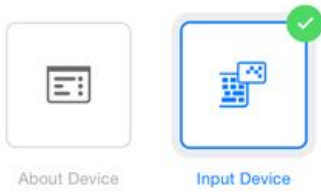


Restart



Shut Down

5. If no issues are found, the screen will look like the image below. The trackpad calibration is verified.



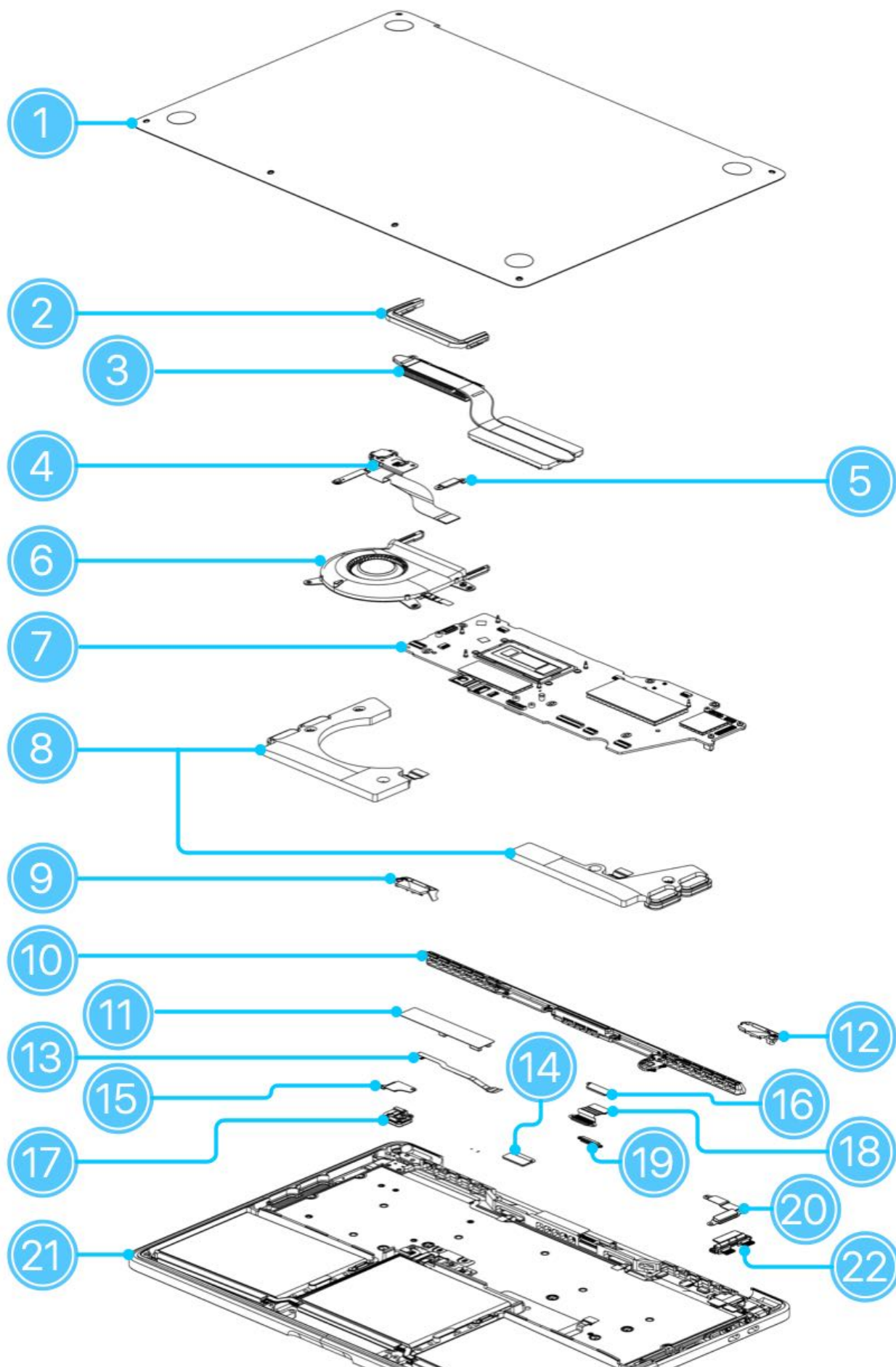
6. If issues were found in the Force Check, Actuator Check, or the Actuator Calibration, the screen will look like the image below and the Trackpad Calibration Check suite should be run again. If the computer fails a second time, a top case replacement is recommended.

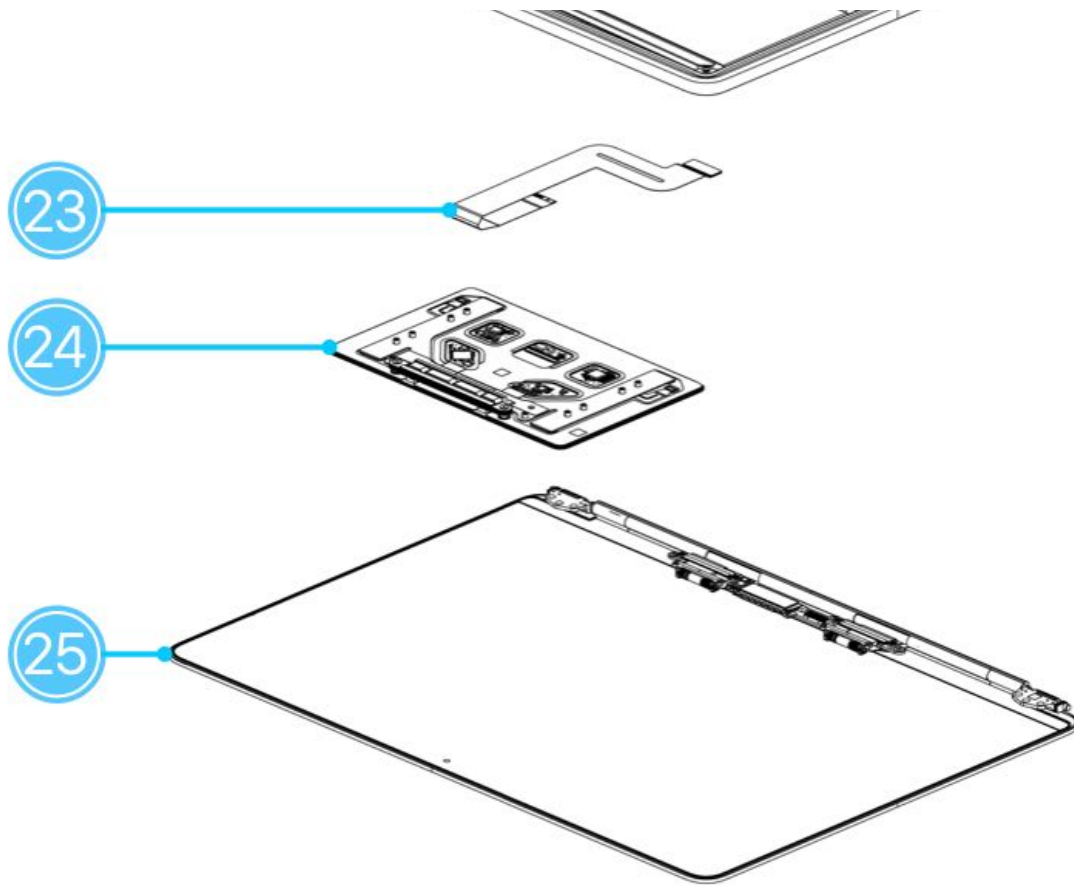


- ✓ Actuator Calibration
- ✓ Critical Error Test
- ✓ Open Test
- ! Force Check

MacBook Pro (13-inch, 2020, Two Thunderbolt 3 Ports) Exploded View

Exploded View for MacBook Pro (13-inch, 2020, Two Thunderbolt 3 Ports)





1. Bottom Case

- 923-04011, Space Gray
- 923-04012, Silver

2. Thermal Duct

- 923-04186

3. Heat Sink Kit

- 076-00476

4. Audio Board Flex Assembly

- 923-04166, Space Gray
- 923-04167, Silver

5. Cowling, Audio Board Flex Assembly

- 923-03212

6. Fan

- 923-04170

7. Logic Board with Integrated Graphics

- 661-14770, 1.4GHz, i5, 8GB, 256GB
- 661-14771, 1.4GHz, i5, 8GB, 512GB
- 661-14772, 1.4GHz, i5, 8GB, 1TB
- 661-14773, 1.4GHz, i5, 8GB, 2TB
- 661-14774, 1.4GHz, i5, 16GB, 256GB
- 661-14775, 1.4GHz, i5, 16GB, 512GB
- 661-14776, 1.4GHz, i5, 16GB, 1TB
- 661-14777, 1.4GHz, i5, 16GB, 2TB
- 661-14778, 1.7GHz, i7, 8GB, 256GB

- 661-14779, 1.7GHz, i7, 8GB, 512GB
- 661-14780, 1.7GHz, i7, 8GB, 1TB
- 661-14781, 1.7GHz, i7, 8GB, 2TB
- 661-14782, 1.7GHz, i7, 16GB, 256GB
- 661-14783, 1.7GHz, i7, 16GB, 512GB
- 661-14784, 1.7GHz, i7, 16GB, 1TB
- 661-14785, 1.7GHz, i7, 16GB, 2TB

8. Speakers, Left and Right, Pair

- 923-04169

9. Clutch Cover, Right

- 923-04181

10. Vent/Antenna Module

- 923-04168

11. BMU Mylar Cover

- 923-04323

12. Clutch Cover, Left

- 923-04182

13. BMU Signal Flex Cable

- 923-01448

14. Cowling, Trackpad Flex Cable

- 923-03215

15. Cowling, Touch ID board Flex Cable

- 923-04184

16. Cowling, eDP Flex Cable to TCON connector

- 923-01310

17. Touch ID Board

- 661-15734
- 923-04171, flexure (not shown)

18. eDP Flex Cable with Integrated Cowling

- 923-03524

19. Cowling, eDP Flex Cable

- 923-04172

20. Cowling, L-Shaped (Touch Bar touch flex cable, Touch Bar display flex cable, I/O board flex cable)

- 923-04173

21. Top Case Assembly with Battery (includes battery, keyboard, Touch Bar flexes, and microphone)

- 661-15736, ANSI, Space Gray
- 661-15737, ANSI, Silver

Note: Regional top cases have the same base part number, but they include a language code prefix (for example, Italian = T 661-15736). Be sure to choose the correct keyboard language when ordering a top case. To help determine the correct country code and keyboard language, refer to [How to identify keyboard localizations](#) (HT201794). The language code prefixes are:

- AB: Arabic
- B: British (Great Britain)
- BG: Bulgarian
- C: Canadian French
- CH: Chinese Simplified
- CR: Croatian
- CZ: Czech
- D: German
- DK: Danish
- E: Spanish
- F: French
- FN: Belgian
- GR: Greek
- H: Norwegian Bokmal
- HB: Hebrew (Israeli)
- IS: Icelandic
- J: Japanese
- KH: Korean
- MG: Hungarian
- N: Dutch
- PO: Portuguese
- RO: Romanian
- RS: Russian
- S: Swedish
- SF: Swiss French
- SL: Slovak
- SM: Swiss Multilingual
- T: Italian
- TA: Taiwanese
- TH: Thai
- TQ: Turkish-Q (Turkey)
- TU: Turkish-F (Turkish)
- VN: Vietnam
- Z: English International

Top case keyboards may not be available in all localizations.

22. I/O Board

- 923-04165

23. Trackpad Flex Cable

- 923-04164

24. Trackpad

- 661-15992, Space Gray
- 661-15993, Silver

25. Display Assembly (includes TCON board and spring tensioner cables)
















- 661-15732, Space Gray
- 661-15733, Silver
















Not Shown:

- **Battery Cover**
 - 923-01318
- **Heat Sink CPU Springs**
 - 923-03522
- **USB-C 61W Power Adapter**
 - 661-10160
 - AR661-10160 (Argentina)
 - HN661-10160 (India)
 - MY661-10160 (Malaysia)
 - PA661-10160 (APAC)
 - TA661-10160 (Taiwan)
 - TU661-10160 (Turkey)
 - VN661-10160 (Vietnam)

MacBook Pro (13-inch, 2020, Two Thunderbolt 3 Ports) Screw Chart

Screw Chart for MacBook Pro (13-inch, 2020, Two Thunderbolt 3 Ports)

<p>923-01189 Torx T5</p>  <p>BMU (1)</p>	<p>923-01190 Torx T3</p>  <p>eDP Flex Cable with Integrated Cowling (2)</p>	<p>923-01286 Torx T3</p>  <p>Display Clutch Covers (4)</p>
<p>923-01407 Torx T5</p>  <p>Heat Sink CPU Springs (4)</p>	<p>923-02513 Torx T3</p>  <p>Cowling, L-Shaped (3) Cowling, Touch ID, Upper (1)</p>	<p>923-03284 Torx T5</p>  <p>TCON Board (4)</p>
<p>923-03286 Torx T3</p>  <p>Cowling, eDP Flex Cable (2)</p>	<p>923-03289 Torx T5</p>  <p>Cowling, Trackpad Flex Cable (2)</p>	<p>923-03290 3mm Hex</p>  <p>Heat Sink Arm (1)</p>
<p>923-03526 Torx T5</p>  <p>Cowling, Audio Board Flex Assembly, Upper (1)</p>	<p>923-03527 Torx T5</p>  <p>Cowling, Audio Board Flex Assembly, Lower (1)</p>	<p>923-03540 Torx T5</p>  <p>Speakers (5)</p>
<p>923-03557 Torx T5</p>  <p>Trackpad, Middle (2)</p>	<p>923-03558 Torx T5</p>  <p>Trackpad, Side (8)</p>	<p>923-03559 Torx T5</p>  <p>I/O Board (2)</p>

<p>923-03910 Torx T3</p>  <p>Touch ID, Outside (4)</p>	<p>923-03911 Torx T3</p>  <p>Touch ID, Middle (2)</p>	<p>923-04174 Pentalobe</p>  <p>Bottom Case, Upper Corners, Space Gray (2)</p>
<p>923-04175 Pentalobe</p>  <p>Bottom Case, Lower Corners, Space Gray (2)</p>	<p>923-04176 Pentalobe</p>  <p>Bottom Case, Center, Space Gray (2)</p>	<p>923-04177 Pentalobe</p>  <p>Bottom Case, Upper Corners, Silver (2)</p>
<p>923-04179 Pentalobe</p>  <p>Bottom Case, Lower Corners, Silver (2)</p>	<p>923-04180 Pentalobe</p>  <p>Bottom Case, Center, Silver (2)</p>	<p>923-04187 Torx T5</p>  <p>Fan (4)</p>
<p>923-04188 Torx T3</p>  <p>Audio Board Flex Assembly (2)</p>	<p>923-04189 Torx T8</p>  <p>Display Clutch to Top Case (6)</p>	<p>923-04190 Torx T3</p>  <p>Spring Tensioners (4)</p>
<p>923-04191 1IPR</p>  <p>Vent/Antenna Module (12)</p>	<p>923-04192 Torx T3</p>  <p>Cowling, Touch ID, Lower (1)</p>	<p>923-04193 Torx T3</p>  <p>Cowling, eDP Connector to TCON (2)</p>

923-04255
Torx T5



Logic Board to Top Case (3)

923-04256
Torx T5



Logic Board to Antenna Ground Clip (1)

923-04257
Torx T5



Logic Board to Top Case, upper
corner(1)

MacBook Pro (13-inch, 2020, Two Thunderbolt 3 Ports) Screw Location Diagrams

Screw Location Diagrams for MacBook Pro (13-inch, 2020, Two Thunderbolt 3 Ports)

Contents:

- Audio Board Flex Assembly
- Battery Management Unit (BMU) Bottom
- Case
- Clutch Covers
- Display
- Embedded DisplayPort (eDP) Flex Cable
- Fan
- Heat Sink CPU Springs
- I/O Board
- Logic Board
- Speakers
- Touch ID Board
- Trackpad
- Vent/Antenna

Audio Board Flex Assembly

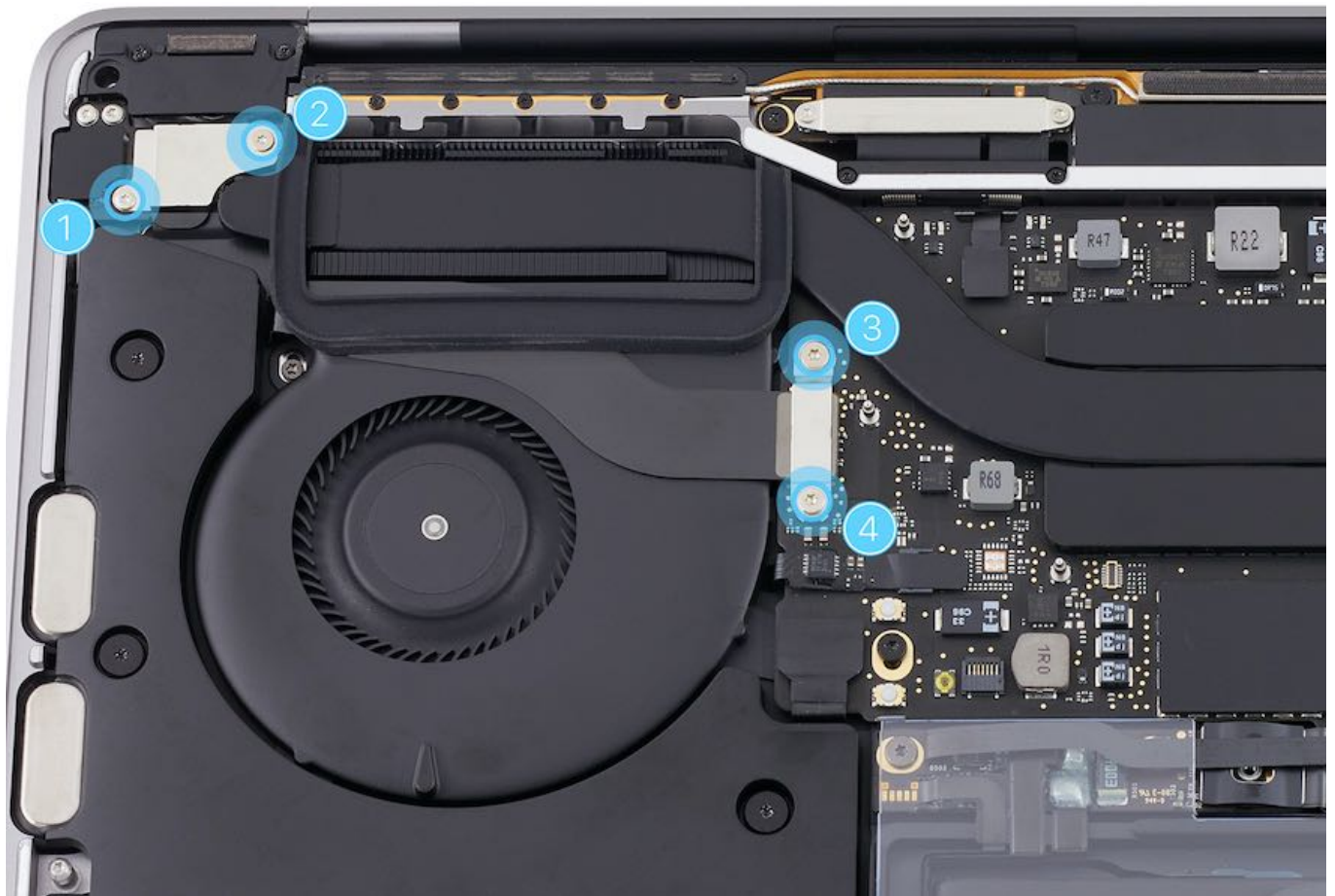
#1

#2

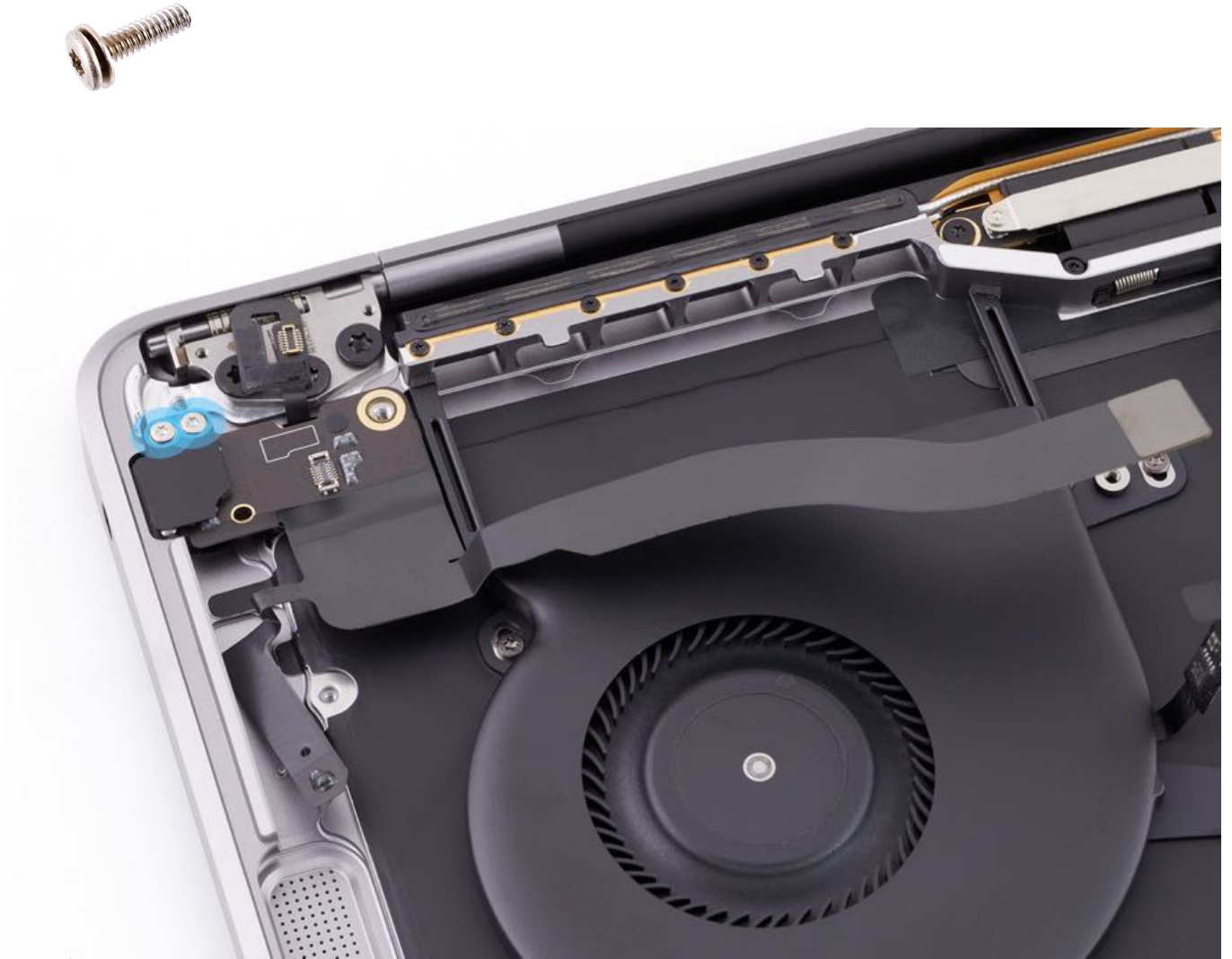
#3

#4

T3: 923-03554 (1) T3: 923-02513 (1) T5: 923-03526 (1) T5: 923-03527 (1)



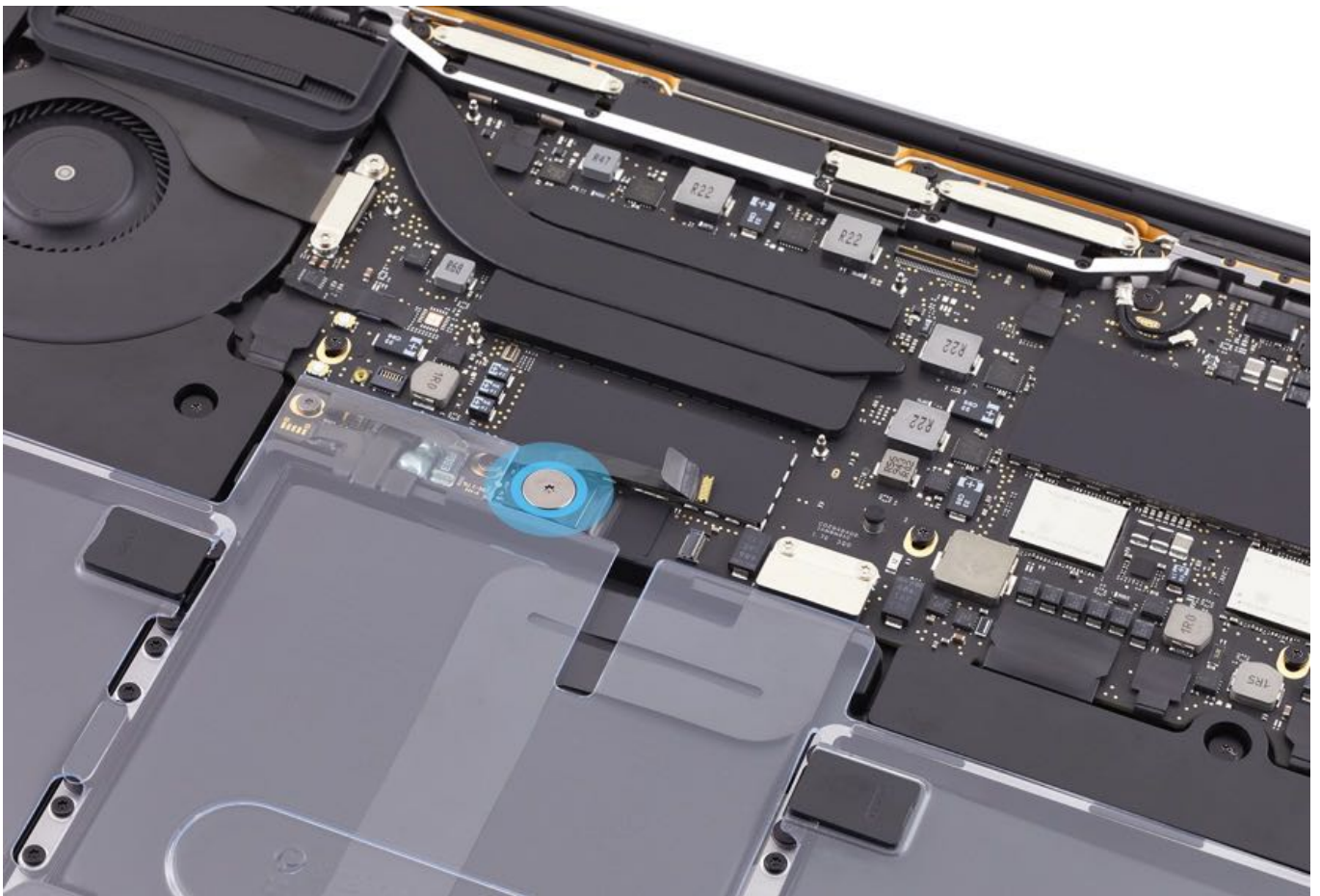
- T3: 923-01189 (1)



Battery Management Unit (BMU)

- T5: 923-01189 (1)





Bottom Case

#1

#2

#3

Pentalobe: 923-04174 (2), space gray Pentalobe: 923-04175 (2), space gray Pentalobe: 923-04176 (2), space gray

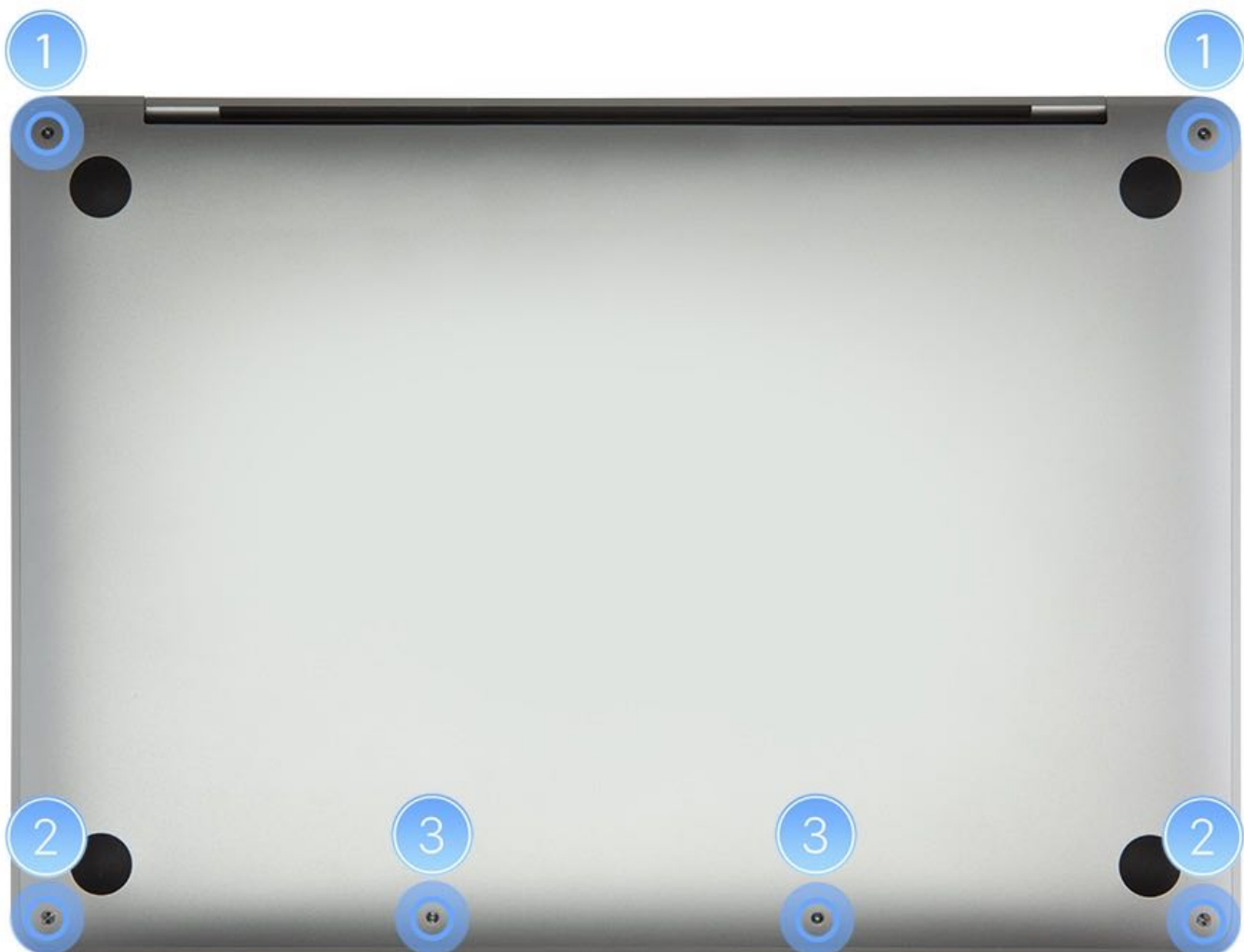


Pentalobe: 923-04177 (2), silver

Pentalobe: 923-04179 (2), silver

Pentalobe: 923-04180 (2), silver

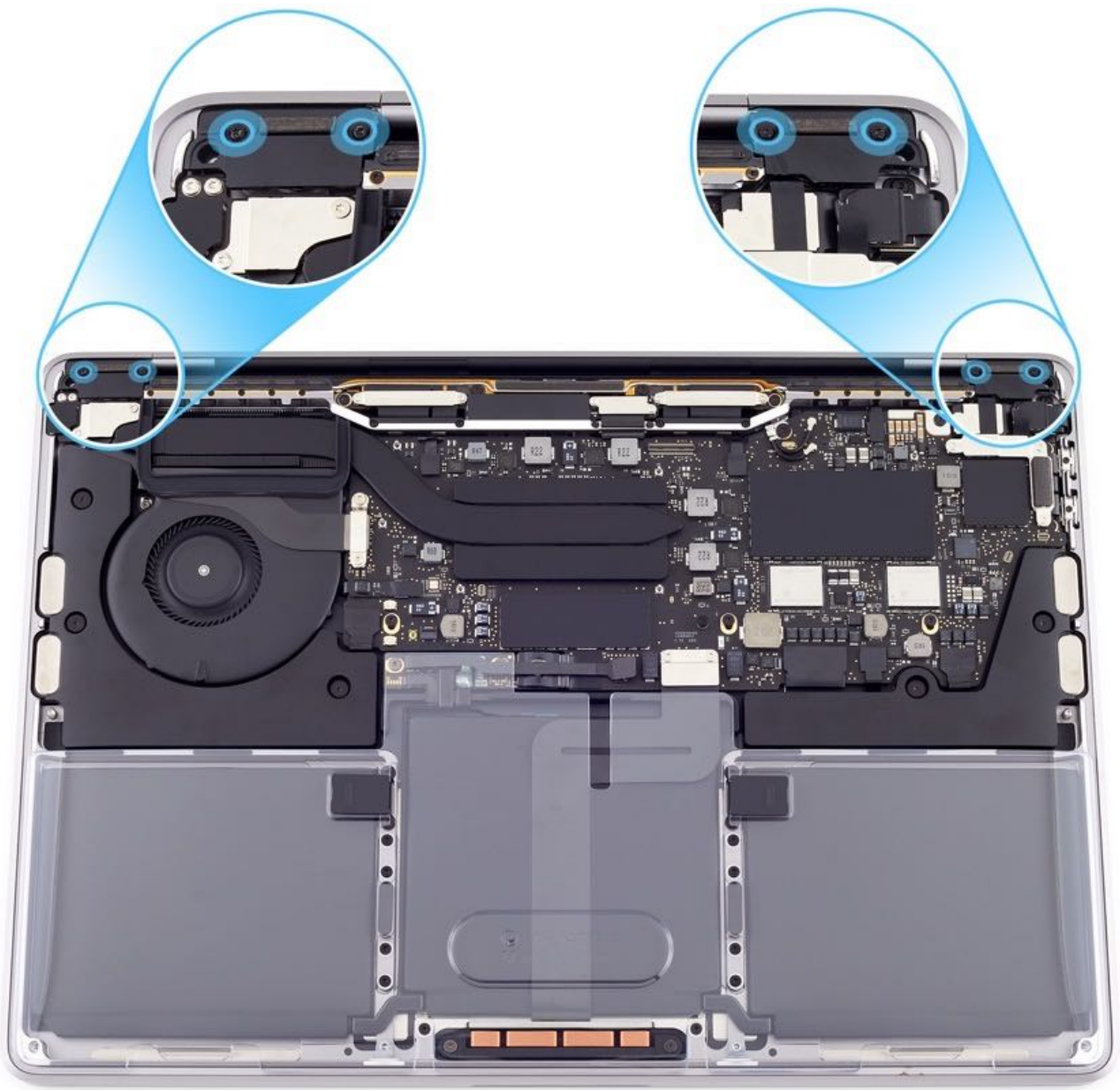




Clutch Covers

- T3: 923-01286 (4)

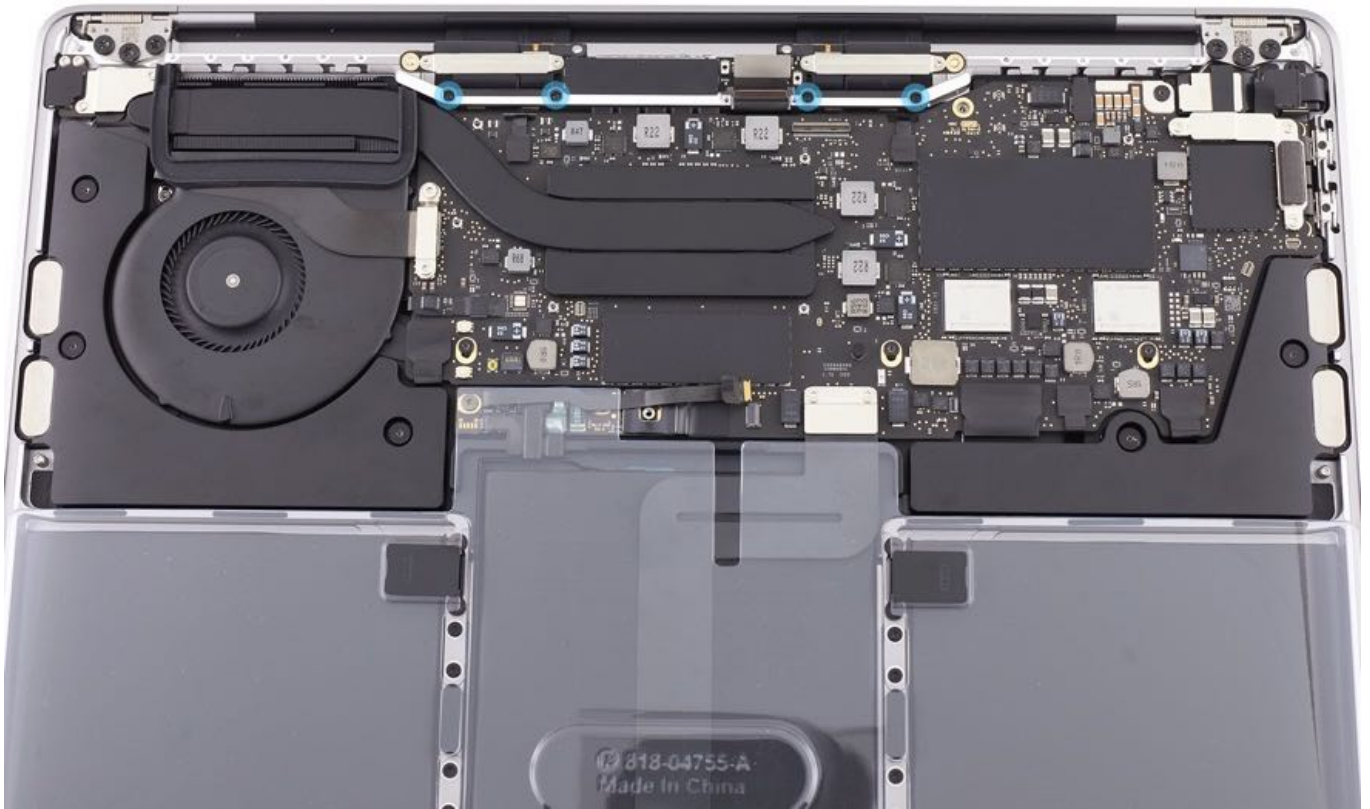




Display

- T3: 923-04190 (4), spring tensioners





- T8: 923-04189 (6), display clutch hinges



Embedded DisplayPort (eDP) Flex Cable

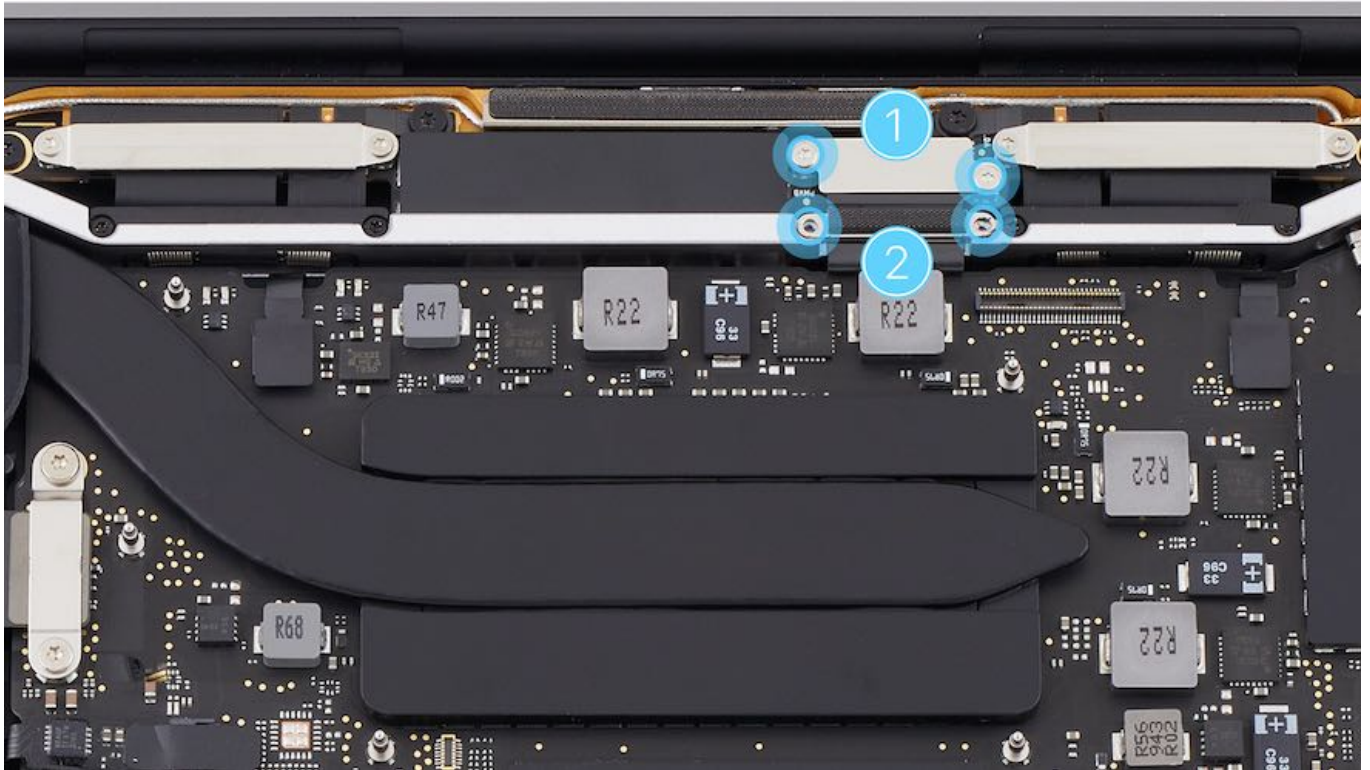
#1

T3: 923-04193 (2), eDP flex cable cowling to timing controller (TCON) board



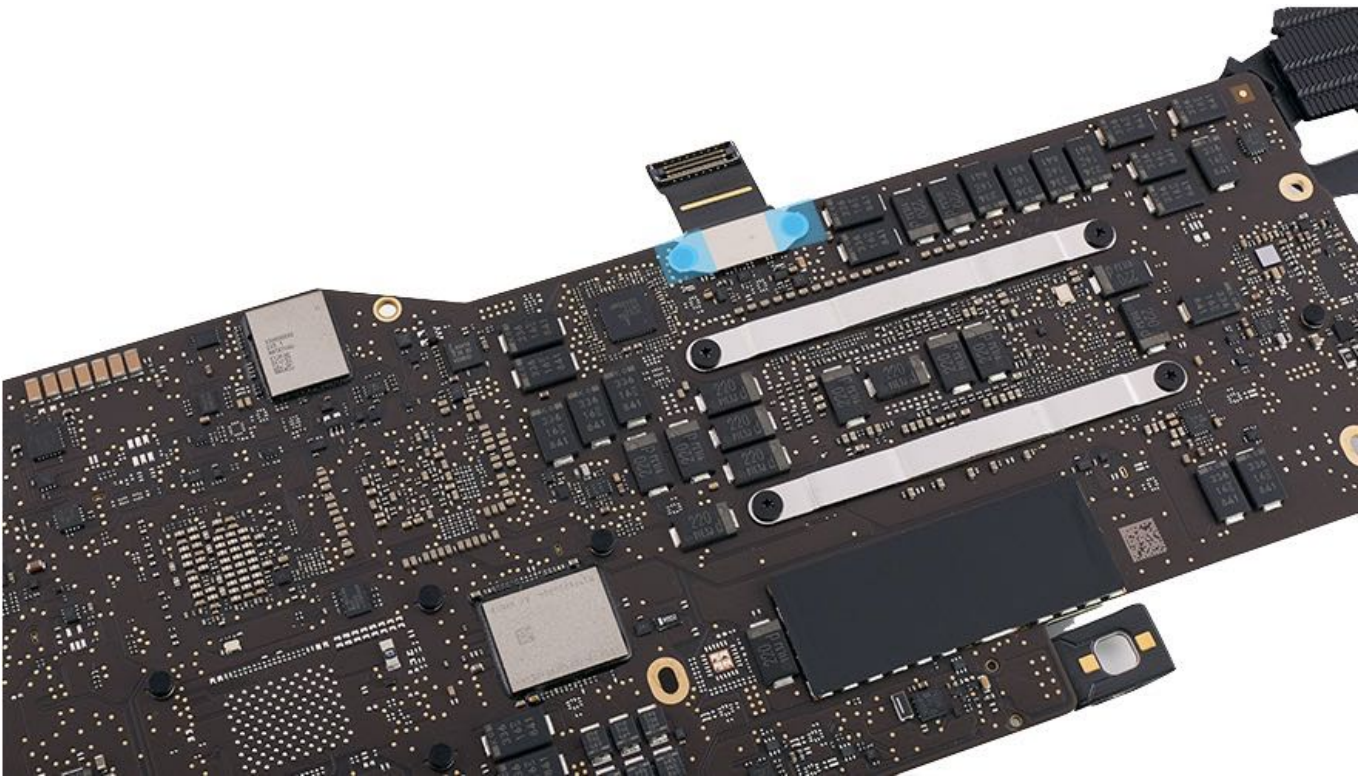
#2

T3: 923-03286 (2), eDP flex cable cowling to top case mid-wall



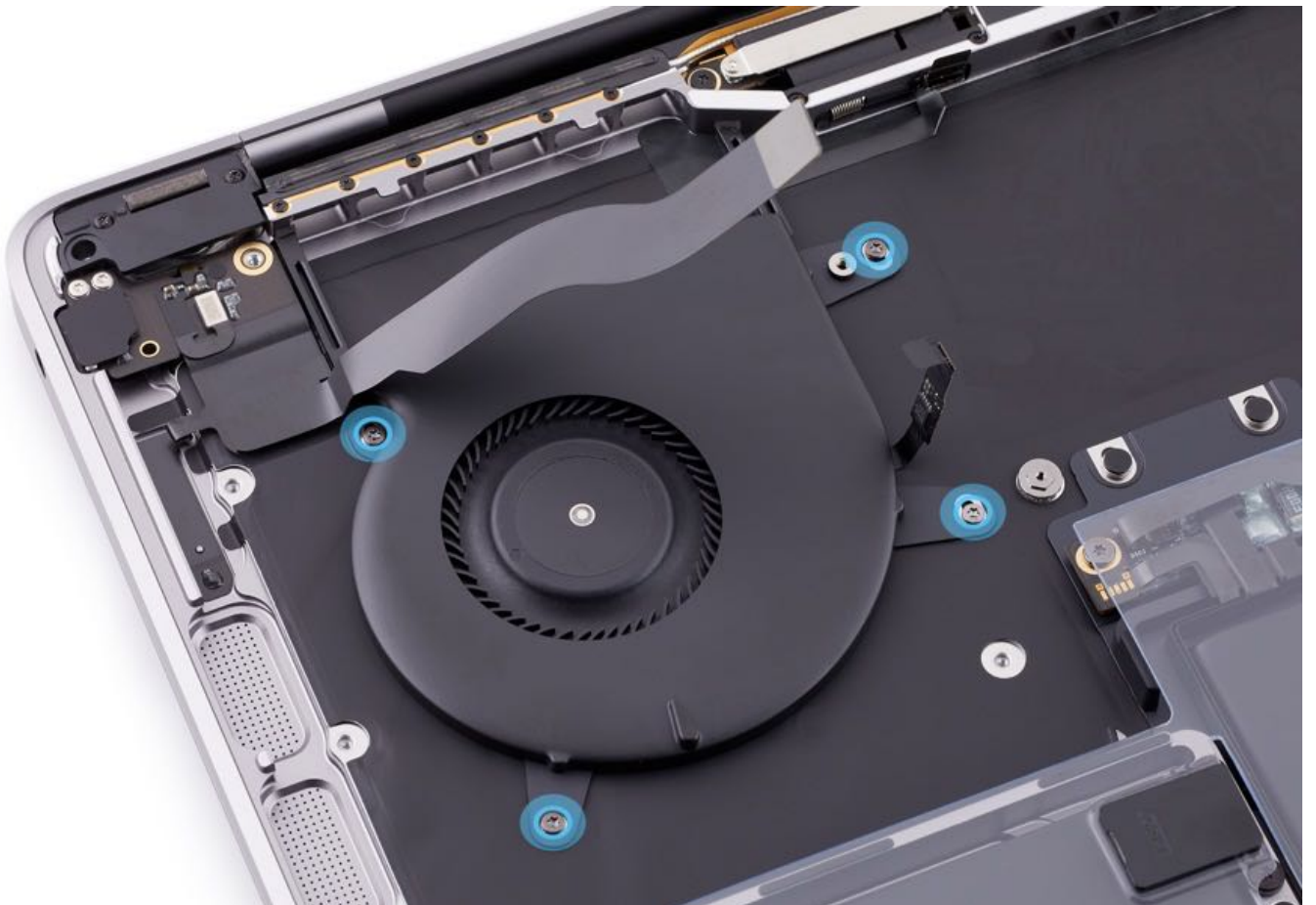
- T3: 923-01190 (2), eDP flex cable cowling to logic board





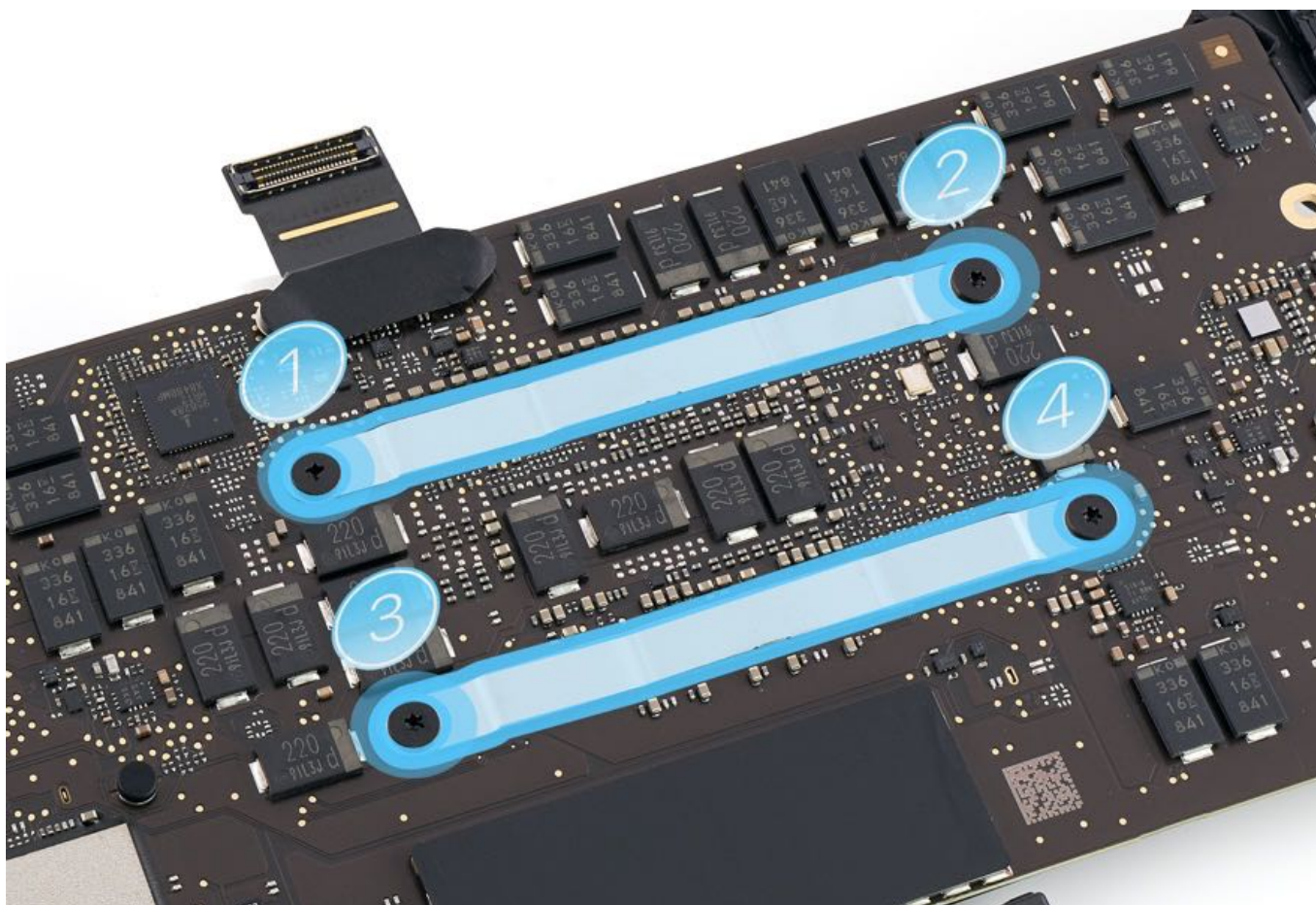
Fan

- T3: 923-04187 (4)



Heat Sink CPU Springs

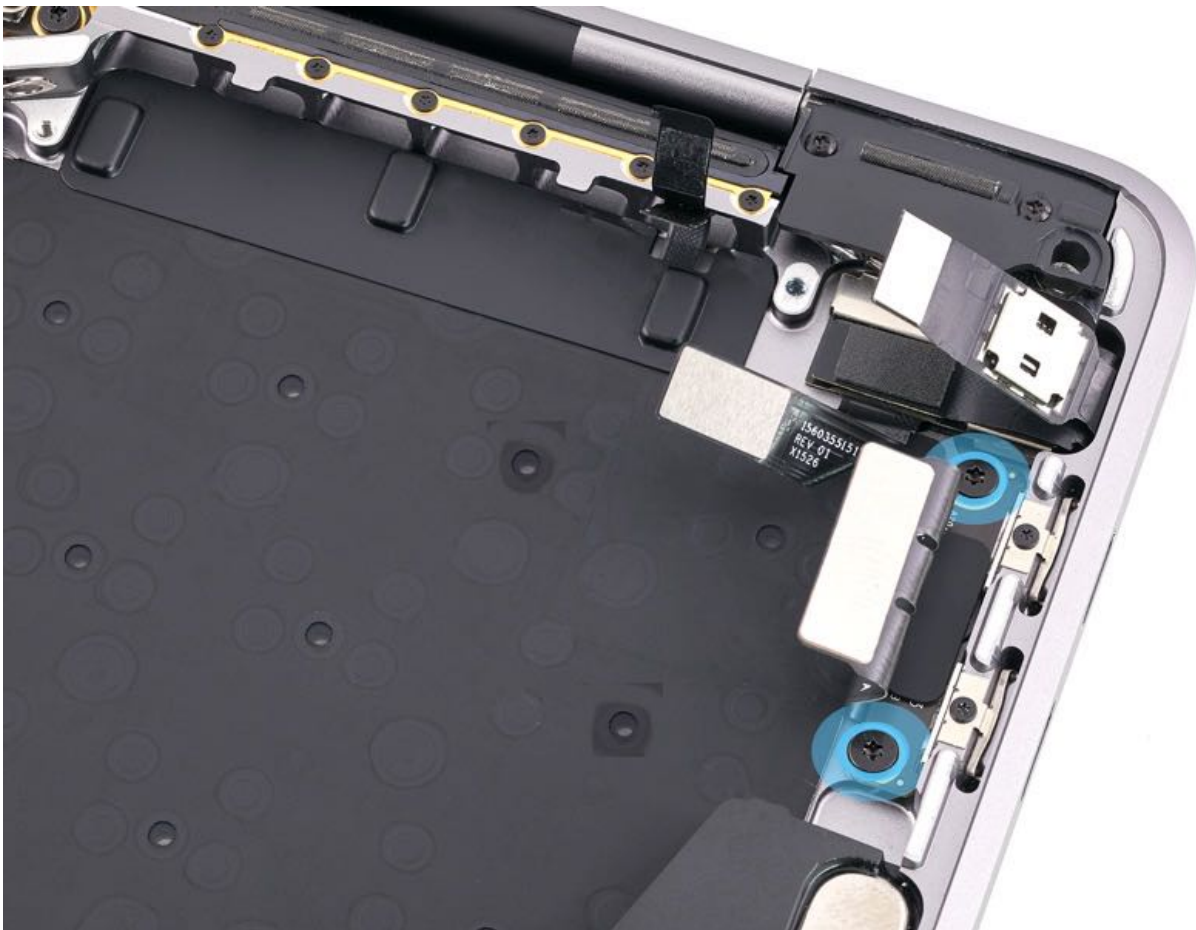
- T5: 923-01407 (4)



I/O Board

- T5: 923-03559 (2)





Logic Board

#1

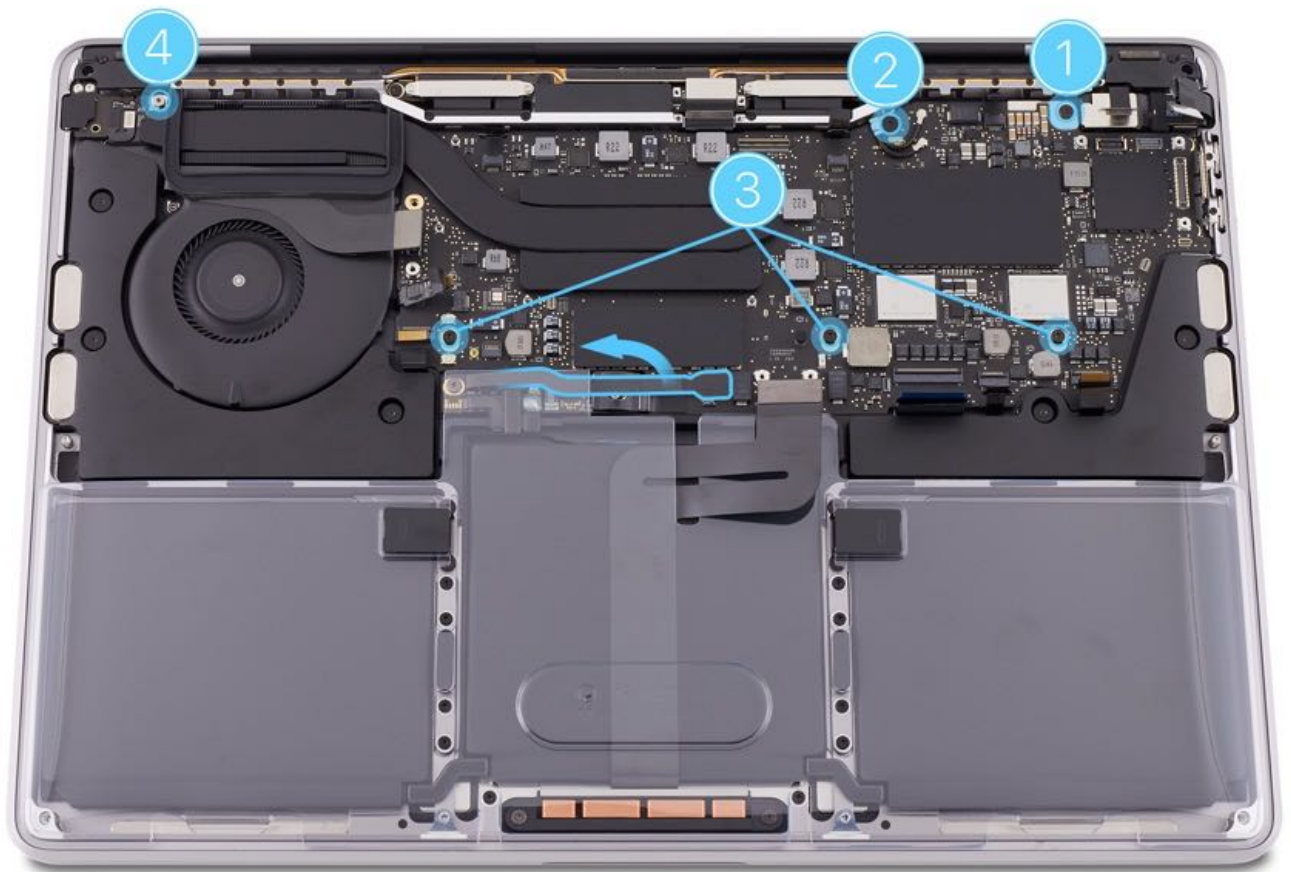
#2

#3

#4

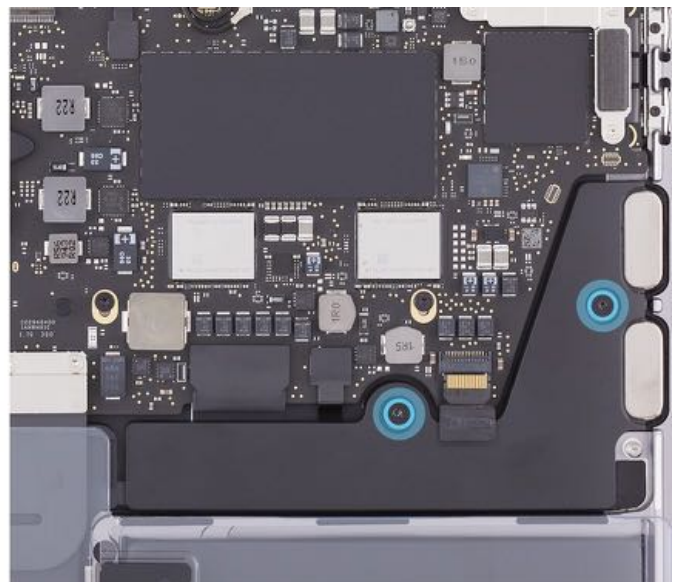
T3: 923-04257 (1) T3: 923-04256 (1) T5: 923-04255 (3) 3mm hex: 923-03290 (1)





Speakers

- T5: 923-03540 (2)

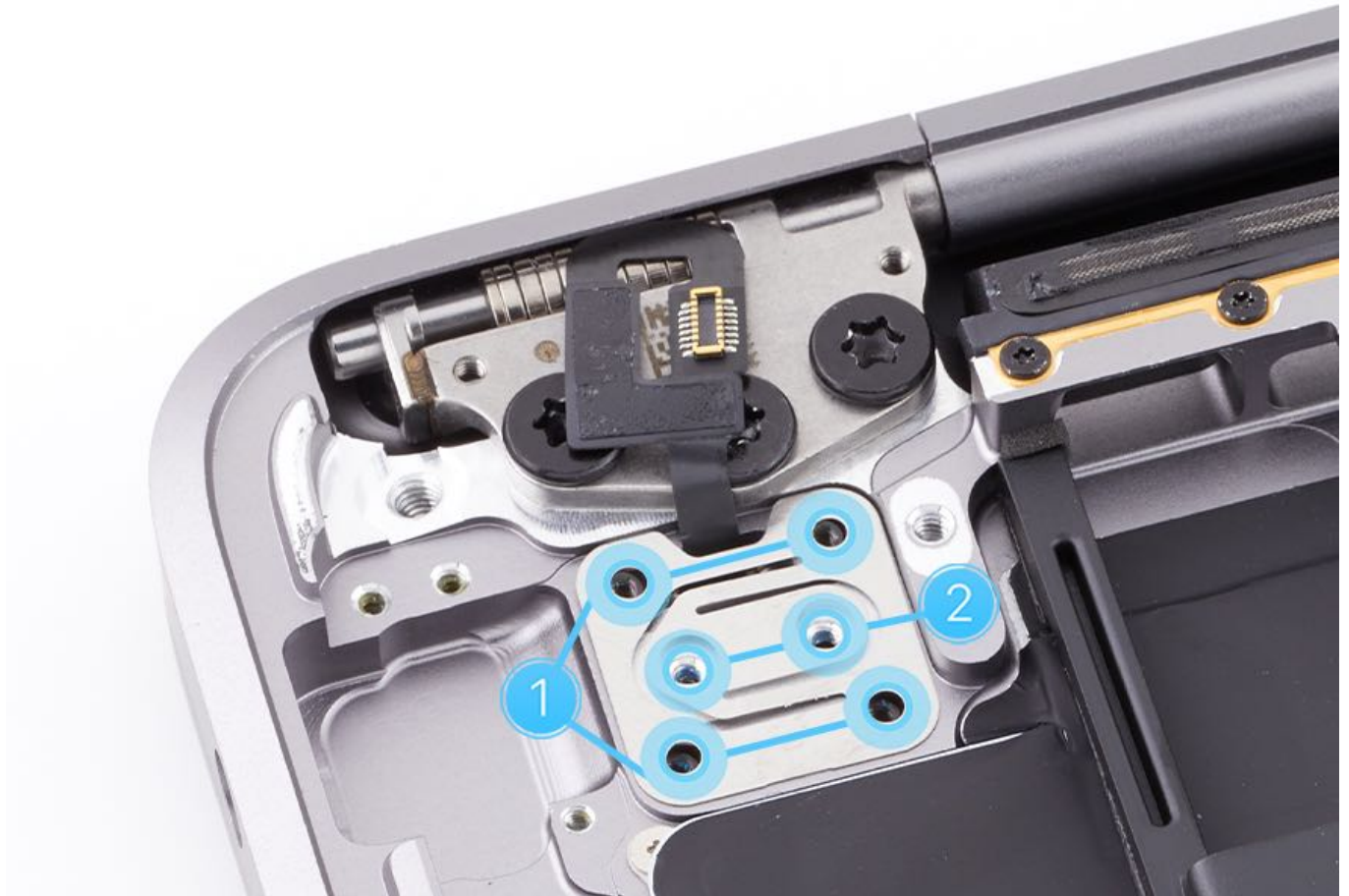


Touch ID Board

#1

#2

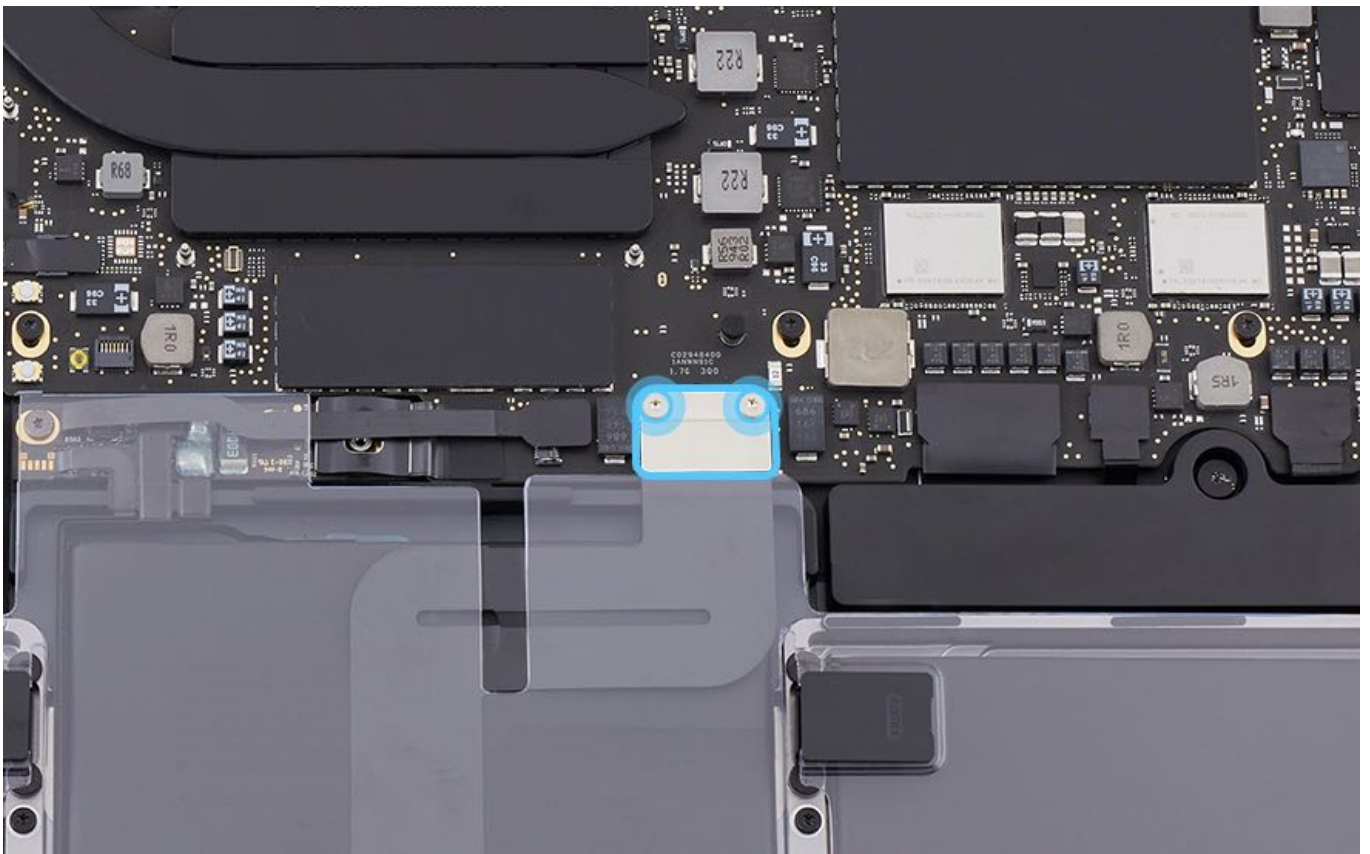
T3: 923-03910 (4), outer corners T3: 923-03911 (2), center



Trackpad

- T5: 923-03289 (2)

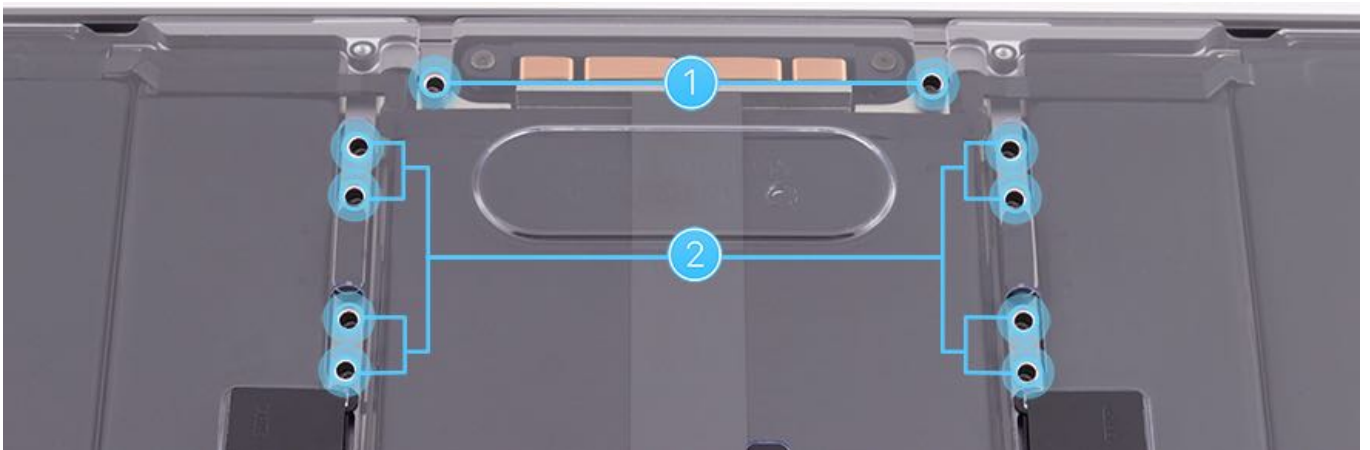




#1

#2

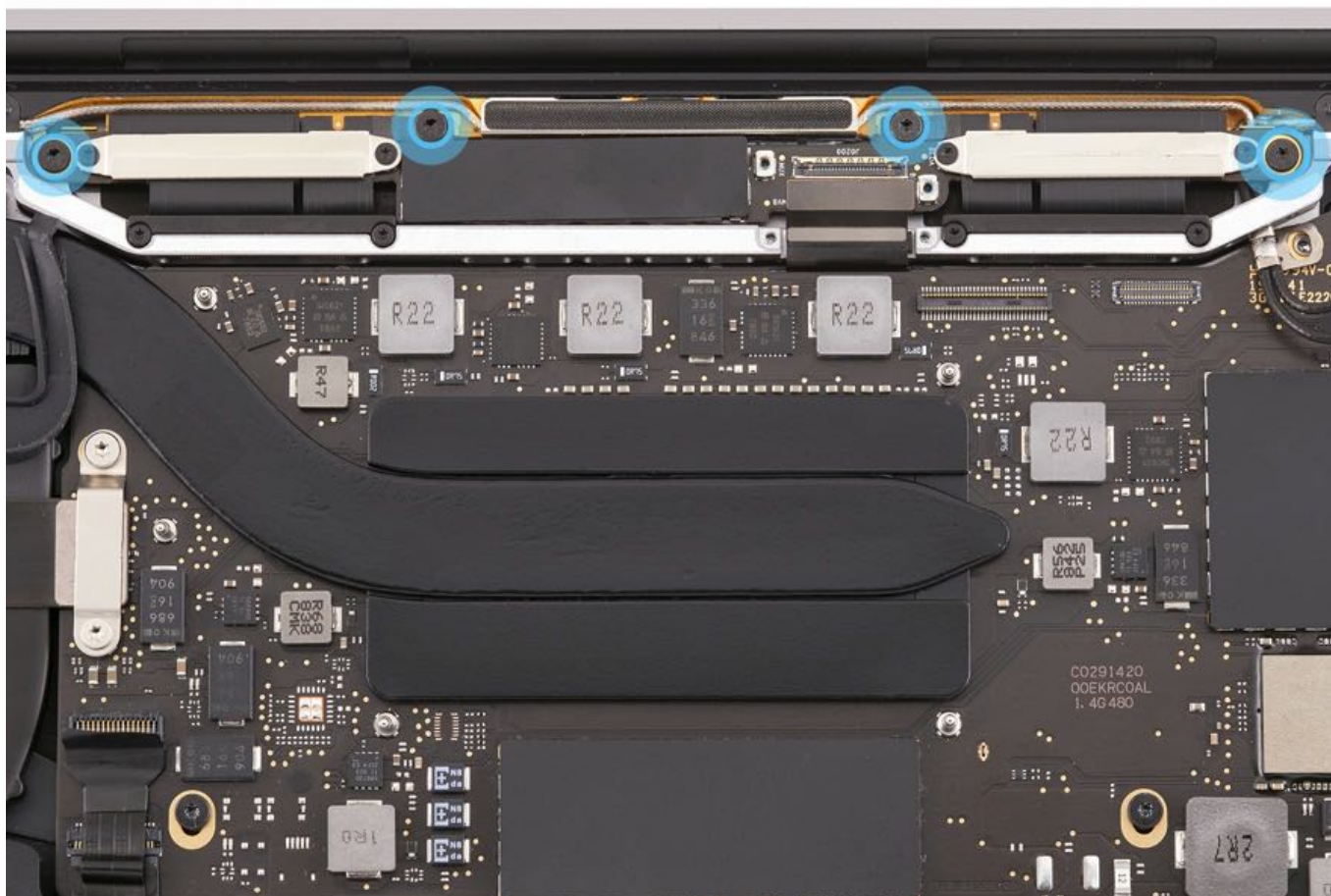
T5: 923-03557 (2) T5: 923-03558 (8)



Vent/Antenna

- T5: 923-03284 (4), TCON board to vent/antenna





- 1IPR: 923-04191 (12)

